SA349

PERFORMANCE HOW-TO

Powder Coating

A HOW-TO GUIDE

For Automobile, Motorcycle, Bicycle & Other Parts

INCLUDES

- ***Stripping and Prepping Parts***
- ***Professional Application Techniques***
- ***Selecting the Best Powder Supplies***
- ***Purchasing the Right Kit for the Job***

Jeffrey Zurschmeide

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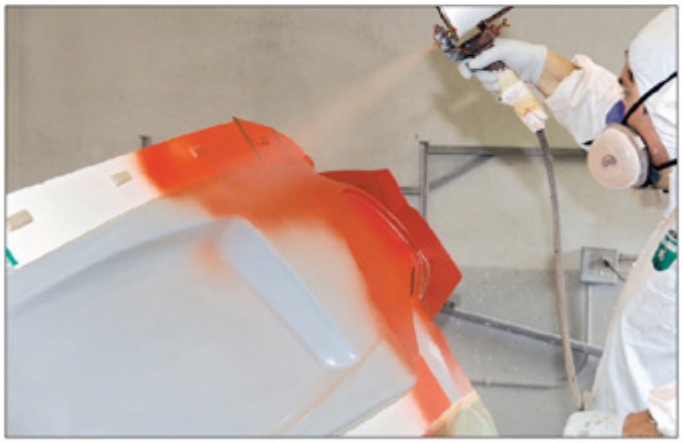

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Title Page:
Fiberglass and composite surfaces are usually sprayed with liquid gel-coat. This gives the parts some of the properties of powder coat, but gel-coat is not nearly as tough as powder coat.

Back cover:

Top:
When using the dual-voltage gun from Eastwood, you use the identical technique as with the original HotCoat gun. The only difference is in the electrical charge used to stick the powder to the part. You can leave this system on high voltage unless you're working on a part with a complex shape.

Middle Left:
Some parts are more difficult to spray than others. To get powder into the valleys between the cooling ribs, we turned the gun sideways and boosted the air pressure a little. The powder was propelled into the low areas. This will be a nice dress-up item under the rear end of a racing BMW.

Middle Right:
Powder has been applied to the spring, and it has cured in the oven. The results are spectacular. The lesson is simple and easy: Don't skimp on your cleaning and prep!

Bottom:
When spraying a metal part with powder coat, you need to insert plugs and mask off all areas that will not receive powder finish. These silicone plugs come in a variety of sizes, and they are well suited to keeping powder out of threaded fittings and any places you don't want powder to get.

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A great number of people have helped bring this book to fruition. First is my great friend and colleague Dan Burrill, whose support and enthusiasm cannot be replaced or understated. Mark Scholz also put in some substantial time and effort helping out with the work on coating projects for the book. Thanks also to my editor, Paul Johnson, who keeps me honest and on task.

I must acknowledge the great support received from The Eastwood Company. Eastwood built its business supporting automotive hobbyists starting with its powder coating products, and it remains the gold standard for the home restorer and fabricator. Throughout this book you find frequent reference to Eastwood products, and for full disclosure, those products were provided by Eastwood at no cost to me. Although it may be tempting for some to see a cynical relationship in this, the fact is that I don't have to embellish the truth: Eastwood products are clearly the best available, and if you try all the products I have tried in the research phase of this book, I believe you will agree with that assessment.

ABOUT THE AUTHOR

Jeffrey Zurschmeide is an inveterate tinkerer, and loves to learn new skills and putter around in his workshop. Whether it's traditional coal-fired blacksmithing or learning to lay up dry carbon fiber, he is ready to give it a try and then write about the process.

Jeffrey lives in Oregon, where he earns his living as a freelance automotive journalist, writing for a variety of magazines such as *SportsCar, Sports Car Market, Loud Pedal, Amici di Maranello,* and others. He also writes about new cars for *The Oregonian* newspaper.

Jeffrey's prior books include the *Subaru High Performance Builder's Guide*; *Automotive Welding: A Practical Guide* (with Russell Nyberg); *New MINI Performance Handbook*; *How To Design, Build & Equip Your Automotive Workshop on a Budget*; and *How to Fabricate Automotive Fiberglass & Carbon Fiber Parts* (with Dan Burrill), all in CarTech Books' SA Design series.

INTRODUCTION

When I began this book, I had never powder coated a single item. The closest I'd been to the process was a visit to a commercial powder coating business to do an interview for an article I had been assigned. That's unusual because most books of this nature are written by experts, people with years or even decades of experience with the process. So why should this book be helpful to you? Simply put, because you are right where I was when I started, and powder coating is not difficult to do with a little help and advice.

In this book I focus on the most common applications for powder coating, and perform a few "what if" experiments to see how they turn out.

The organization of chapters is designed to give you usable information as you begin your experience with powder coating. It may seem as if I spend a lot of time discussing workshop construction, and I do. That's for the simple reason that your projects turn out better and your shop stays cleaner if you prepare for your work properly. You will have a lot more fun, too!

I also spend a lot of time talking about cleaning processes for metal, ranging from a simple wipe-down with a solvent to removing serious layers of grunge from automotive parts. This is because getting your parts absolutely clean is critical to success in powder coating. As with any other painting or coating project, 95 percent of success is in the preparation process. So I look at every possible cleanser available, including many that are perfectly safe for use in your garage and some that are not safe and should be left to professionals.

With a small investment in equipment and supplies, you can turn ordinary metal parts into colorful dress-up items for automotive, boating, aviation, workshop, and household use. Powder coating sets your projects apart from the vast majority of rattle-can paint jobs.

You will find step-by-step procedures for typical powder coating projects you can undertake at home. Whether it's coating a wheel, a spring, or a simple decorative wind chime, I gave it a try. In addition to the information collected in this book, powder coating products often come with their own instructions, and you should always follow those instructions, especially when they concern temperatures and times for curing.

I also spend some time looking at real results that happen when powder coaters fail to do proper prep; let these mistakes help you avoid bad results of your own. Also, I get creative and break a few rules and look at what happens; it doesn't always turn out badly!

This book is designed to be very useful to the at-home fabricator who's looking to restore or fabricate parts for a project car, race car, hot rod, kit car, or motorcycle. But really, anything that can be powder coated is the canvas for your imagination. One project I stumbled into used a set of stainless steel mixing bowls. Powder coat comes in a variety of bright colors and I coated the outsides of these bowls and turned them into something more than a basic kitchen utensil.

Chemical cleansers can make short work of rust, impurities, and old paint or powder coats. The ability to clean up parts has value far beyond just powder coating.

The basic tool of powder coating is a paint sprayer designed for dry powder instead of liquid paint. You need 120 volts of household current and a compressor of any size to make it work.

Eastwood includes this chart of powder coat colors and textures with every kit. It's a handy reference for all the colors in the Eastwood catalog, but there are hundreds more available from various online suppliers.

By following the text and the photos in this book, almost anyone who has the tools and the patience will be able to powder coat anything that can fit in a conventional kitchen oven.

I mention several name brands and products. If a product you like is not mentioned by name, it's only because it is impossible to mention everything available on the market today. Also, I have not personally tested every product on the market. I simply chose a few representative products that I have used, or that I have seen in use to show what's widely available on the market and what is being used by home fabricators today. I have not included prices because those change constantly.

CHAPTER 1

POWDER COATING FUNDAMENTALS

Powder coating (also called powder painting) is a process of using static electricity and compressed air to cause electrically charged powdered plastic to adhere to a metal surface in an even distribution. Then the part is baked at a specified temperature for a specified time. The powder melts and flows together and then cures to a hard surface with excellent adhesion to the underlying metal.

That's the actual powder coating process in a nutshell, apart from the extensive work of precleaning the parts. The point is that you have a tremendous variety of powders to choose from, each with different properties. Different brands of powder have highly variable quality and different compositions. Some metallic powders include metals, as you might suspect from the name. You can purchase powders with wrinkle finishes; matte, gloss, or mirror finishes; clear finishes; and many others including simulated chrome (which is much tougher than actual chrome plating).

Spraying powder coat is easy, and in this photo I am coating an exhaust manifold. The residue simply sweeps right up. With a little practice, you'll be coating parts like a professional.

You can easily powder coat any metal because metals conduct electricity very well; the powder really wants to stick because of the electrostatic charge applied by the powder gun. You can also powder coat some temperature-resistant plastics and wood products, including medium-density fiberboard. It may be more difficult to get a good coating on items that do not conduct electricity, but as long as they can survive the curing process, you can coat them. All powders cure at less than 425 degrees F, and many cure as low as 340 degrees, which gives you a wide range of materials.

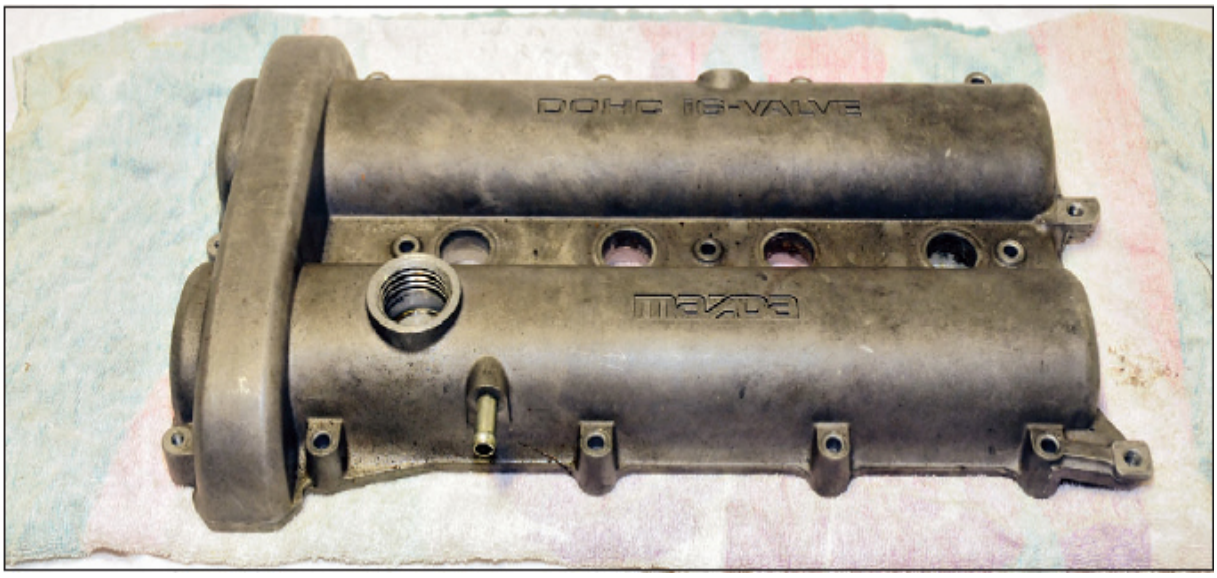
Perhaps the best thing about powder coating is its toughness and resistance to abuse, plus the fact that powder coat is easily removed with paint stripper gel. So if you make a mistake, or just decide to change colors, you can do so easily without damaging the underlying part.

The benefits of powder coating parts are many, especially if the part in question is subject to abuse by exposure to the elements. Any part on the underside of a car, for example, is routinely blasted by rocks and sand, splashed with water (which may be salty in winter, depending on where you live), and doused with grease, road grime, and other substances. Powder coating helps these parts resist damage from the elements, makes them easier to clean, and keeps them looking good!

Find Some Friends and Get Some Help

If I could give you just one piece of advice to help you get good results and enjoy the process of powder coating it would be this: Find some friends or a club and share the work and the results. Finding a club or a group of compatible people in your area helps you keep your projects moving along and fun. The Internet is a nice tool for learning and discussion, but folks on the other side of the country can't help you with your projects, especially when you need four hands to open the oven, position the part, and close the oven before all the heat escapes.

A local circle of friends is also a good way to gain access to tools you may not yet own. The advantage is that if one of you buys a given powder coating gun, or a supply of plugs or powders, then someone else can buy a different kit or the parts washer, and a third person can buy the oven or the blast cabinet. You don't need to use every tool for every project, and there's a lot of down time for any tool, so why not share the expense? Treat your club or your group of friends right, and you always have help when you need it. ■



This perfectly ordinary cam cover from a Mazda Miata is one of the projects in this book. Coating parts such as this is the main thing that most home powder coaters do with their equipment. When word gets around that you can do this, be prepared to be the most popular person in your club.

With just a little work, that plain aluminum cam cover has now been turned into a prized dress-up item that makes any Miata's engine bay look fantastic and racy. The finish will last for decades.

The Chemistry of Powder Coating

On navy ships, many of the most junior sailors are assigned to painting detail. An old joke goes that if it moves, they should salute it. If it doesn't move, they should paint it. The reason for that policy is because salt is one of the most corrosive substances on Earth. When you combine salt, water, and air with bare iron or steel, the metal starts to oxidize immediately, producing rust. Even so-called "stainless" steel with high chromium content rusts.

Powder Coating as Paint Primer

If you're creating a custom look and the powder just doesn't match the color of paint you're using elsewhere on the car, you should know that powder coat makes an excellent primer for traditional paint. You can use sandpaper to scuff the powder coat for better adhesion. Be sure to use a "hot" solvent that helps the paint really melt into and bond with the powder coat for best results!

Before you can apply that beautiful powder coat, you must remove absolutely all rust, scale, dirt, and grease from your projects. This rusty hook was found in a metal recycling center and purchased for the challenge of de-rusting it.

Here's the same hook after a good soak in Eastwood Rust Dissolver and a little wire brush work with the bench grinder. It looks great and is ready to be powder coated.

If you've seen what happens to cars in Hawaii, you've seen the effect of salt, water, and air. Hawaiians call the effect "Dragon Rust" because of the way it just eats up a car; and this is in a part of the world that never sees snow or ice. Any scratch through the paint is an opportunity for a rust infection to get going. The benefit of powder coat in that kind of environment is that it's much harder to scratch than regular paint.

And it's not just iron and steel you have to worry about; many metals oxidize readily. Aluminum oxidizes into a gritty powder, and the oxidization can permeate the body of the metal and weaken it over time.

The best way to slow the rusting process is to seal the metal in some kind of material that is not subject to immediate degradation by salt, water, and air. Paint has historically been that substance, although pitch and tar were popular for centuries.

Eastwood offers a perfect Ford blue for dressing out Ford engine bays. It's also just a really nice blue that you can use elsewhere. Bugatti owners take special notice of this shade, as it's a perfect French racing blue as well!

Paint has the advantage of being easy to apply, and being able to cure (dry) under a variety of conditions. As a liquid, paint is made with some form of solvent, which can be as simple as water, but more often the solvent is a volatile organic compound. These are defined as solvents that have unusually low boiling temperatures, which is to say that they evaporate at normal room temperatures. For example, liquid formaldehyde evaporates at any temperature above -2 degrees F. But formaldehyde is a particularly caustic chemical, so its use is restricted in the modern age. However, using solvents in paint makes it possible to spread those products in cold weather (down to about 35 degrees F), and they still cure.

The method of application and curing is the biggest difference between paint and powder coating. Whereas paint suspends the latex, acrylic, or

other coating substance in the solvent and relies on the solvent evaporating away to leave a smooth coating, powder coat dusts the substance onto the surface of the target part, using an electric charge to create attraction between the coating substance and the surface to be painted. Then the powder is cured by heating the coating particles until they melt and flow together.

Interestingly, the underlying plastics used in powder coating are very close or identical to the plastics used in fiberglass and composite fabrication. Polyurethane, polyester, acrylic, and plastics mixed with epoxy are all popular bases for powder coating. Fiberglass fabrication relies on a catalyst to cure a resin made of polyester or polyurethane (with or without epoxy); powder coating uses heat to trigger the same result: a hardened plastic finish.

The Physics of Powder Coating

Powder coating guns are fundamentally different from paint guns in that they use electrical current to encourage the powder to stick to the part being coated. Every powder coating kit includes a power cord, a transformer box, a ground wire, a trigger for the electrical current, and the gun itself. The gun also includes a fitting for compressed air, a place to mount the cup of powder, and a trigger that actuates the compressed airflow.

The gun also has a metal rod that runs down the center of the barrel. This rod receives a positive electrical charge when the electrical trigger is actuated. The ground wire is clipped to the part (or to any metal piece in contact with the part, such as the hanger) and is the negative side of the same current flow as the gun. The electricity really wants to get to that ground wire, but because the electrical charge cannot jump the distance between the gun and the part (more on that later) it attaches itself to the powder particles as they pass through the barrel of the gun. The powder is being blown through the gun by the compressed air.

Once the particles are in the air, they are attracted to the metal piece attached to the ground wire. They stick to the part and their passenger electrons can then make the trip to the ground wire.

This process is why you have to be sure to actuate the electrical trigger attached to the transformer box as well as the air trigger on the gun. If you

forget the electrical trigger, the powder has no particular attraction to the part, and you'll wonder why the coverage is so thin for all the powder you're using. Obviously if you forget to pull the gun trigger, no powder blows through at all. It's the electrical side that is most often forgotten.

This is also why you have to keep the nozzle of the gun at least 4 to 5 inches from the part. If that metal rod comes too close to the part, a spark jumps and makes a divot in your smooth coat of powder.

Powder Coating Color and Composition

You can mix and change paint colors. When you buy paint at a store, you select the precise color you want and they have a formula for it. Usually they start with a can of white paint and add a few drops of this color and a few drops of that color. After they mix it you get the precise color you wanted.

The nature of powder coating products is fundamentally different. When a powder is made, the color is put in while the product is still a liquid. The product is hardened, after which it is ground into powder before you purchase it. Powder, of course, is millions of tiny pieces of plastic. So if you mix a red powder and a blue powder, the two powders do not change each other even in the slightest way. The two colors may intermingle, but they cannot truly mix to create a new color.

So although red paint and blue paint can be mixed to create purple paint, you cannot get a true purple from mixing red and blue powder. In fact, you get something that may be a good deal *better* than purple.

So what happens when you mix different colors of powder? All the tiny specks of plastic intermingle in a more-or-less even way (depending on how thoroughly you shake and stir the mixture) that is fundamentally random. I suspect that different powders have different sizes or weights of particle because it seems as if mixed powders never quite come out evenly. But the powders both flow together a bit and cure in the same way during the baking process.

The effect of a mixed powder is that of millions of tiny spots of red and blue together. Your eye cannot see every tiny dot of red or blue, so it averages the colors. And that "average" changes in different lights and when looking at the finished piece from different angles. Some very high-

priced automotive paints behave in the same manner; the color seems to change before your eyes as you move the finished part in your hands. From some angles it looks more reddish, and from other viewpoints it looks more blue.

I mixed some bright red with some Ford blue and came up with this purple tone that tricks your eye and appears to change colors as you look at the part from different angles. You can experiment to come up with your own custom mixes.

The bowl takes on a whole different sheen when the powder is cured. This mixture never looks quite the same from project to project, but it never fails to be stunningly beautiful.

Powder makers do not intend for their products to be mixed, so you're kind of on your own with this technique. You can experiment and find a blend that you like. Chapter 8 includes a finished project mixing red and blue powders, and it turned out beautifully.

Thermoplastic versus Thermosetting Powders

For the most part, you don't hear much about thermoplastic versus thermosetting powders because almost all the powders you will use are the thermosetting type. But if you are faced with a choice, know that thermoplastic powders have the ability to melt and flow over and over again.

Thermosetting plastic powders, on the other hand, are designed to be heated and cured just once. A chemical change takes place within the powder and it hardens as it cools. Thermosetting powders are tougher when attacked by chemicals, heat, or concussion. Repeated heating can burn thermosetting powders, but (almost paradoxically) they are better than thermoplastic powders at dealing with high temperatures that do not reach curing temperature. As a rule, parts that reach temperatures of more than 200 degrees F repeatedly, such as exhaust manifolds, should not be powder coated (see page 15 for a discussion of ceramic coatings that are appropriate for such parts).

Powder Coating Options

Powder coating has been around since the early 1970s, and today more than 15 percent of industrial finishing processes use powder coat. Commercial powder coating operations are in business in every major city in the United States and around the world. For industrial and automotive metal protection, it's hard to beat powder coating for its toughness and durability. Moreover, powder coating is far more environmentally friendly than traditional painting. Cities that restrict the use of solvent-based paints for air quality reasons accept powder coating operations.

Powder coating protects the roughest, toughest machinery as well as the household items you depend on daily. It provides a more durable finish than liquid paints can offer, while still providing an attractive finish. Powder coated products are more resistant to diminished coating quality as a result of impact, moisture, chemicals, ultraviolet light, and other extreme weather conditions. In turn, this reduces the risk of scratches, chipping, abrasions, corrosion, fading, and other wear issues.

Professional Powder Coating Shop

In a very short time you will be a skilled powder coater. Your results will be every bit as good as the professionals at a fraction of the cost. But there are still circumstances in which you should choose to take a project to a professional shop.

“I don’t think anyone ever leaves here with a bill over $500, unless it’s something really exotic,” says the owner of one powder coating business specializing in automotive restoration.

Chiefly, those circumstances are when a project is too large to fit into your curing oven. You may also find that a particularly complex shape benefits from the pro touch, or the shop may have access to a powder that you can’t get elsewhere. Most professional powder coating operations have about 400 to 500 different colors of powder in stock at any given time, and easy access to hundreds more. You can just look through the catalog and pick the perfect color to match any need.

Chrome finishes and gold tone products are also good candidates for the professionals, simply because they have plenty of experience in getting perfect results with these more finicky finishes.

Be aware that your selection of color may have a substantial impact on the price you pay for professional (and home) powder coating. Some products require a primer coat, especially pearlescent or metallic colors. These benefit from a layer of white or clear underneath them for the color to really pop.

Translucent and metallic colors are available, along with wrinkle finish, veined, and several other textures. There is little you can't achieve with powder coating.

The cost to take a part to a professional shop varies quite a bit. Some shops are happy to take one-off or small pieces, while others base their business on a more industrial scale. So shop around to find a shop that you can work with. Once you have some experience, you can speak to the shop about exactly what you want to achieve.

Another reason to use a pro shop is for a part that is very difficult to clean properly. Most shops have their own cleaning equipment, or they work with a cleaning business on a regular basis. If you have a complicated shape such as a differential housing or an intake manifold and you just can't get all the gunk out of the nooks and crannies, there's no shame in taking that project to a professional.

You may find that after spending a lot of time, effort, and money to find, acquire, and restore a particularly rare or challenging part, it's money well spent to have it coated professionally.

You don't have to use expensive custom cleansers. Basic products (such as this Berryman B-12 Chemtool) available in any auto parts store or grocery store work just fine to clean your parts before powder coating.

Powder Coating versus Traditional Painting

The main reason to choose powder coating over traditional painting is that you can remove a part, clean it, apply the powder, bake the part, and get it back onto your car (or wherever) in about an hour. Plus, when you're done with the coating, the surface is far tougher than with any liquid paint. Powder coat resists chipping, scratching, and chemical attack far better than paint. Powder is substantially more flexible than dried paint, which is why it is used on automotive springs, torsion bars, and other items that flex in the normal course of their use.

Essentially, you have to use just the right kind of chemical to remove powder coat, but the usual suspects such as brake fluid, won't touch it. What's more, powder coat also resists fading and degradation from UV light, moisture, and other environmental factors, so you can use powder coated parts outdoors in direct sunlight for years.

You can perform home powder coat curing in an ordinary kitchen electric oven, or a toaster oven, or even with infrared heat lamps. It's best to have a dedicated oven for curing; they are commonly inexpensive or even free through craigslist online.

Another big benefit is that powder coating produces very little in the way of volatile organic fumes. There's a little smoke and fume when you bake the coating to cure it, but nothing like solvent-based paint fumes and the danger of inhalation that they bring to your home shop. Powder coating is gentle enough on the environment that you can perform the whole process in your garage or workshop, provided you have good ventilation.

If you keep your kitchen-size curing oven outside, there's really no concern about fumes at all. For small parts that you can cure in a toaster oven, the amount of smoke and fumes is small enough that you smell it, but that's about all. However, there is dust, so you always need to wear safety goggles and a respirator even though you're not subject to chemical fumes. Powder tends to get everywhere and is quite irritating to your eyes and nose.

Another benefit of powder coating (and difference to painting) is that it is much more forgiving of bad technique. Once on the part, the powder particles can be easily blown off again, if you make a mistake or accidentally touch or brush something against the part. As a rule, the powder holds to the surface very well while you transfer the part to the curing oven.

If you overload a particular section, you can just blow off the powder with some compressed air and start over. You don't have to worry about a little overspray creating drips, sags, runs, or wrinkles. There's no lengthy wet sanding or cutting involved, and the item is ready to use as soon as the part cools.

Powder coat is amazing in its ability to smooth itself during the curing process. You may still have thin and thick spots, especially at first when you're learning to apply the powder evenly, but you'll very shortly achieve professional results, once you've had a bit of practice.

Powder Coating Kit

A powder coating kit includes a transformer box, a grounding wire with an alligator clip, a trigger, and a powder gun. The transformer is plugged into an ordinary 120-volt wall socket. If you have an Eastwood Dual-Voltage kit, the transformer box has a switch for selecting the output voltage. You clip the grounding wire to the item you plan to coat, and when the trigger is actuated the transformer sends a positive charge to the gun. An electrode runs down the middle of the barrel of the gun, and this electrode is positively charged when the trigger is actuated.

The powder gun is a basic style of paint gun. It's a hollow tube attached to a source of compressed air, with an attachment for a cup full of powder. Some of the air pressurizes the powder cup and causes the powder to flow out of the gun. The individual particles of plastic powder take an electrostatic charge as they are blown through the barrel of the gun, and the negative charge at the part being coated attracts the powder particles. The powder particles stick to the part being coated.

Most kits include several empty cups, but you quickly find you need more. One advantage of Eastwood kits is that the powders come in the correct cups; you just screw a cup into the gun and you're ready to go. Other powders come in some kind of plastic bag, and you have to be careful while transferring the powder to a cup. Bad spills happen very easily, and you don't want to use powder that has been contaminated. Consider buying a dedicated funnel for filling powder cups.

A powder coating gun uses compressed air to blow powder particles past a charged rod to give them a static charge. The particles adhere to the part because it's the negative pole of the same electrical circuit.

Because most powders are packaged in plastic bags and must be poured into small cups for use with powder coating guns, you need a set of funnels dedicated to powder coating. Any type of funnel from a thrift store works well.

One of the smartest purchases you can make when you buy your powder coating setup is to get the biggest, fullest accessory kit that is offered. Eastwood has the best accessory kits by far, and you use every item in the kit frequently.

Never Use Conventional Masking Tape

Never use conventional masking tape unless you remove it before you put the part in the curing oven. It's not a fire danger, but the glue on regular masking tape solidifies into an amazingly hard substance during the curing process. You have to sand it off.

For your home powder coating operation you also need a supply of silicone plugs and magnetic masking discs for blocking threaded holes and other places where you don't want powder. The silicone plugs sold by Eastwood can go all the way through the curing process many times without damage. They may get some powder baked onto them, but this does not affect their usability.

Large powder coating material and equipment kits you can buy online also include nonstick heat-resistant tape for masking areas you don't want to coat, a digital infrared thermometer for checking cure temperatures, and a

spool of utility wire for hanging small parts while you coat and cure them. These kits are well worth the money, and you always need more than you think you will. For example, in a basic small-block Chevrolet intake manifold or cylinder head, you need the largest kit of silicone plugs, a good supply of the special masking tape, and the magnetic blocking discs to protect the passages from stray powder.

Beyond the basic kit, you also need an array of cleaning tools and solutions. These include a good amount of rust remover, paint and powder stripper, and a selection of normal cleaners you can obtain at the auto parts store (see Chapters 3, 4, and 5 for more details).

Advanced workers also want to look into metal repair kits, fillers, and soldering/brazing gear. These can be used to fill in pitting and other flaws before coating for a perfectly restored look. Just don't expect these products to bear stress! Never use a weakened part that has been smoothed over in a critical function such as the suspension or in brake systems.

Technologies Related to Powder Coating

A number of sealants are similar to powder coating in that they perform the same function: keeping moisture and oxygen away from your metal, and keeping your parts looking good. It's useful to take a look at each of these and think about when you might want to choose powder coating or one of these other products.

Sealants: POR-15, Bedliner, Plasti Dip

To the untrained eye, sealants such as POR-15 or urea-based spray- or paint-on bed and trunk liners, and even products such as Plasti Dip may appear similar or even identical to powder coating, but they are not the same. Powder coating is a sealant, but that term covers a broad array of products, and each of these products works in a different way.

The POR in POR-15 originally stood for "Paint Over Rust." It is a popular sealant that uses cyanoacrylate to harden its finish. Cyanoacrylate is the substance found in commercial Super Glue. This compound hardens nicely at normal temperatures, and seals surfaces very effectively. But apart from the hardening effect of the cyanoacrylate, the surface is just paint.

Plus, cyanoacrylate coverings are less flexible than powder coating, and are more difficult to remove if you make a mistake or decide to remove the covering later.

Spray-on or roll-on truck bed liner is also marketed as chassis undercoating and as a trunk sealant. It’s all the same stuff: a plasticized urethane that dries and cures like paint. It’s designed to create a heavy coating that stands up to all kinds of abuse, and these products are great for their intended use. But the results are thick and tend to have a knobby surface. Also, these do not seal against rust in any way; if there’s any rust lurking underneath the coating, it continues to grow and eat away the metal. Finally, these products are especially sensitive to the presence of grease or oil on the metal; they peel if any impurities are present on the metal.

These are all fine products to choose when you want their particular characteristics. Choose powder coat when you want the characteristics of that finish.

Ceramic Coating

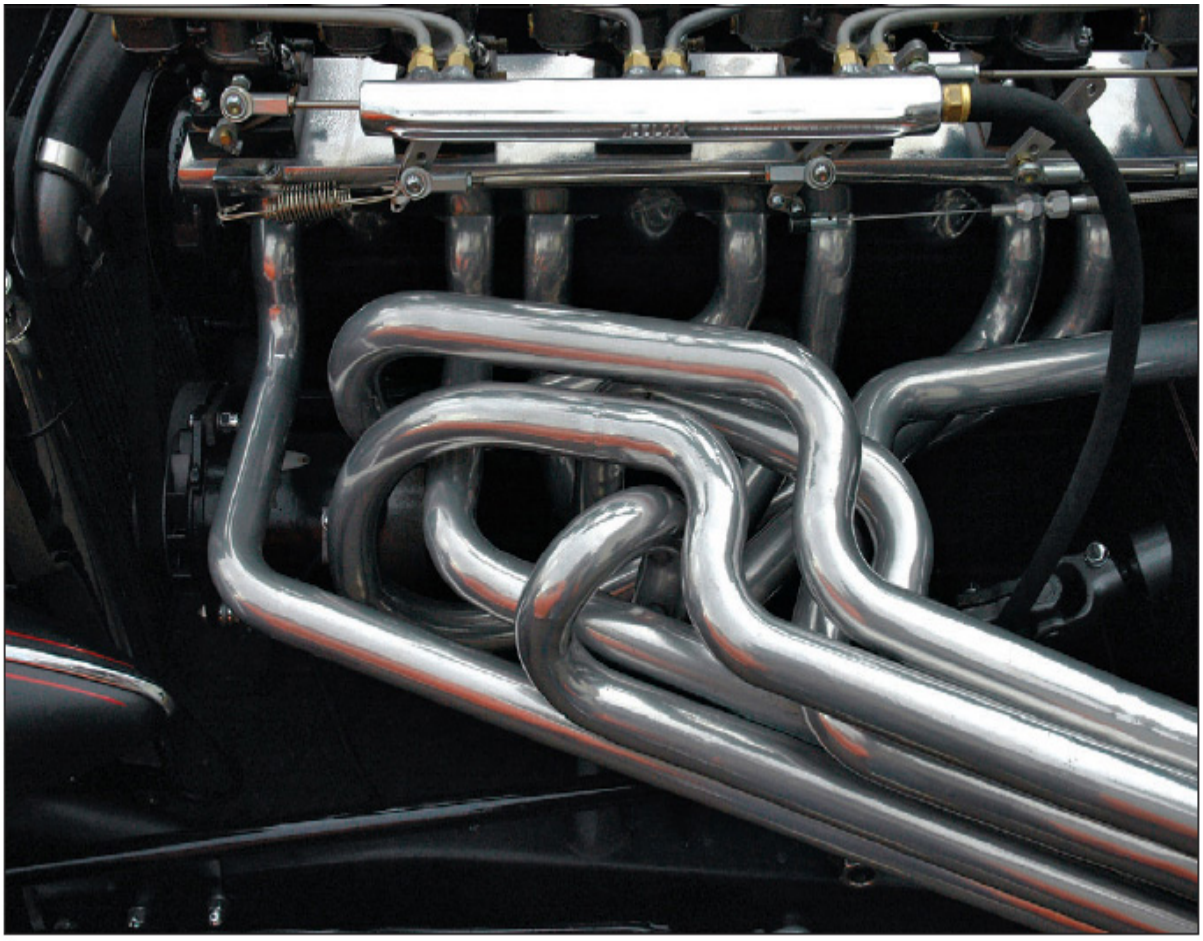
Ceramic coating is a process that results in a coating that looks somewhat similar to powder coating, but ceramic coating is a very different process and as a result, yields a very different coating. However, the two processes are often used on different parts of the same car to great effect.

Ceramic coating is just what the name implies: it is a thin coating of ceramic material, meaning that it is clay-based. The material is sprayed onto a part and then cured in a kiln at very high temperatures, similar to the way a piece of pottery is fired. Various tints and metals are added to the mixture to achieve different colors and metallic finishes.

Ceramic coatings were invented and developed for use by NASA on spacecraft that would have to re-enter the Earth's atmosphere. The key feature of ceramic coatings is an extremely high "heat shear." This means that heat tends to reflect off the coating rather than soak through it, leaving the metal on the other side of the ceramic coat much cooler. That effect, plus really good toughness, makes ceramic coating an excellent choice for any part that gets really hot.

The best use of ceramic coating is when you want to take advantage of that heat shear characteristic and keep the heat on one side of a barrier. The classic example is an exhaust manifold or header. Heat in the engine bay robs power, but you have to evacuate the hot exhaust gases somehow. Ceramic coating on the header or manifold keeps the heat mostly inside the tube, so it can exit the car through the exhaust pipes. The result is a cooler engine bay.

Much as with powder coat, you can get ceramic coatings in virtually any color, with a smooth surface or a textured orange-peel surface to simulate cast iron or a wrinkle texture as with wrinkle-finish paint. You can even order a ceramic coat with a metallic look that simulates chrome, pewter, aluminum mirror black, or any color in between.



Ceramic coating is generally outside the abilities of home hobbyists and amateurs to perform well. It is used on a comparatively small number of parts and is expensive to purchase.

Ceramic coat also seals the cast iron in a manifold or the tube metal in an exhaust header; it prevents rust and keeps parts looking like new indefinitely. If you're powder coating lots of parts on your project, consider ceramic coat for the bits that get really hot.

Ceramic coating is difficult to do yourself at this time. Ceramic coatings cure at temperatures of around 750 degrees F, which are difficult to attain in a readily available oven. However, some ceramic thermal barrier products cure at temperatures as low as 350 degrees, so you may want to give them a try. (Such products have not been tested in the development of this book.)

Spray Painting

If there is one technology that powder coating is designed to replace, it's spray painting. Powder coating is superior to spray painting in absolutely every respect except one, and that factor is convenience. There's nothing more convenient than grabbing a rattle can and giving it a shake before spraying some color on a part.

Spray paint comes in a variety of formulations, designed for different applications. Few people are surprised to learn that with spray paint, you get what you pay for. Cheap spray paint doesn't cover, doesn't hide, and doesn't last. Good spray paint is a much better choice, but still not as good as powder coating if the part can be power coated.

If you need to use spray paint on your project in concert with powder coating, it's best to choose your powder and test-coat a scrap of metal, then take the piece with you when you shop for a spray paint to match the color. There is an element of luck in getting a good match, but if you pick a popular color such as flame red, you should be able to get a very close match.

As with powder coat, paint comes in flat, glossy, textured, or metallic finish. Primers and sanding coats also come in all colors. Spray paints are likely enamels, but may also be epoxy-based. High-heat paints claim to maintain their finish up to 1,000 or 1,500 degrees F, but they offer no heat reflection, as do ceramic coatings. Some paints claim to be designed to neutralize rust, but don't bet on it. Clean your parts equally well for all coating types.

Choose a spray paint that is formulated for the surface you're painting, whether that's plastic, metal, or something else. In most cases, fiberglass and composites count as plastic. Then the same general rules apply to spray paint as to powder coat: Get the parts as clean as you can. Scuffing is okay to give some shape so the paint can adhere, and be careful in your application technique so as not to mar the finish.

The downside of spray paint is that it's easy to get thick and thin spots, runs and drips, and find hair or other particles sticking to the finish. Several coats may be necessary for a really good finish, and you may want to top it all off with a clear coat.

Be sure to let each coat dry completely before applying a new coat, or you'll end up with a mess. Spray paint is dissolved in solvent, and the surface that is exposed to air dries first, while the underside is still wet. The paint eventually "flashes off" the solvent; it comes to the surface and evaporates. If you are already applying another coat when that happens, you get sags and wrinkles in the finish. Many spray paints take days or even weeks to fully cure, and if they are not applied correctly, they may never dry properly.

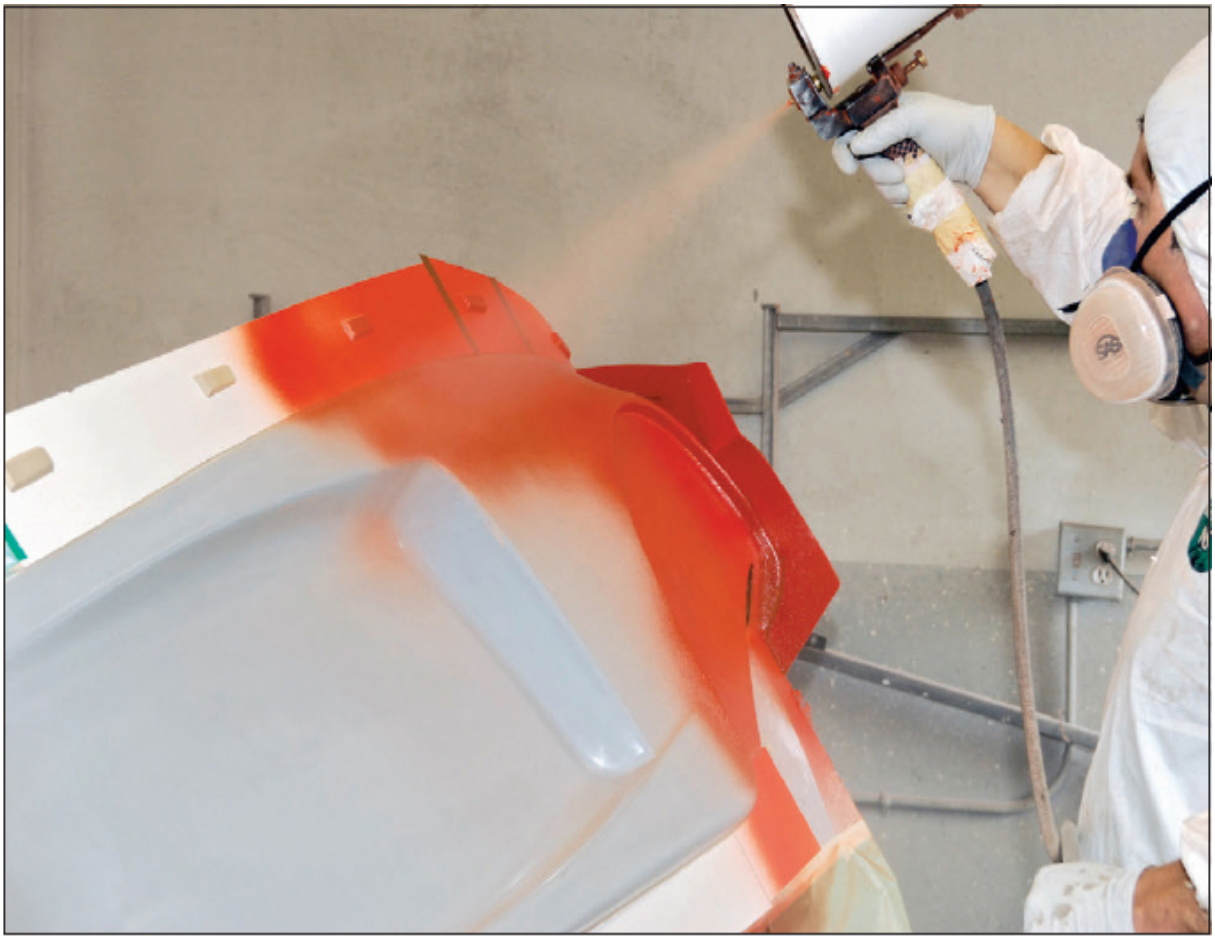
Fiberglassing and Compositing

There's not a lot to say about fiberglass and composites with respect to powder coating because for the most part, fiberglass cannot withstand the temperatures required to cure powder coat, so fiberglass parts cannot be coated. That's unfortunate, because the flexibility of powder coat would match well with the flexibility of fiberglass.

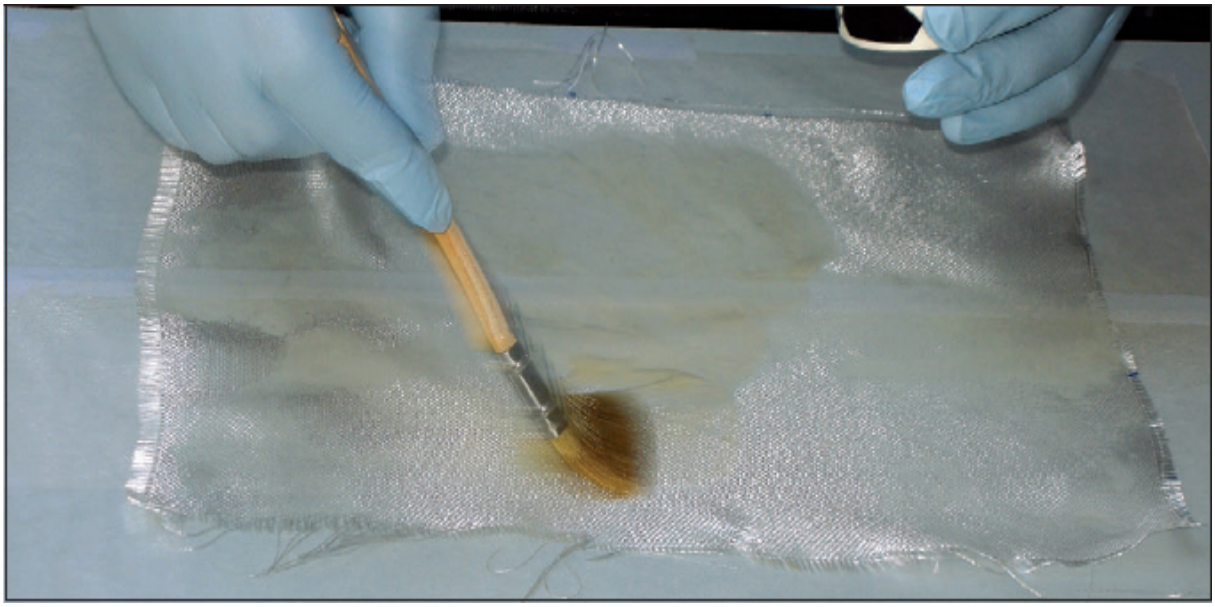
What is called fiberglass is actually a combination or composite of fiberglass cloth saturated with a resin and a small percentage of hardening catalyst that, when wet, is a product that can be shaped or molded until it sets up and hardens. Then, of course, it retains its shape, which is what you want. Fiberglass (with resin added) is also called fiberglass reinforced plastic; the hardened resin is the "plastic" part of the composite.

The part of the fiberglass composite that cannot survive the temperatures required to cure powder coat is not the glass fiber woven cloth or random mat of fibers, but rather the plastic that bonds and shapes the glass substrate. With some ingenuity, a temperature-tolerant type of fiberglass resin may be developed that survives the powder coating process, but for now, it's generally prudent to consider fiberglass out of bounds for powder coating.

But not all composites are fiberglass and some, such as dry carbon fiber, use resins developed for curing in an oven at about 250 degrees F. Some of these resins can survive a lower-temperature powder coating cure, with powders that cure in the low-300-degree range. Generally speaking, people who use carbon fiber prefer to show it off, but it is possible to coat some of these parts. Ask your carbon-fiber supplier for more information.



Fiberglass and composite surfaces are usually sprayed with liquid gel coat. This gives the parts some of the properties of powder coat, but gel-coat is not nearly as tough as powder coat.



Fiberglass and other composites are wonderful products, but if they can be powder coated at all, you have to be extremely careful about the cure temperature, so it's generally not advisable to powder coat these materials.

Electroplating

Along with ceramic coating and spray painting, electroplating is a related technology in that a layer of new material is deposited on the surface of the part to be coated, sealing the underlying metal and protecting it from the elements while delivering a nice finish.

Electroplating uses a process similar to powder coating to deposit the plating metal onto the surface of the part. Here, however, instead of blowing the electrically charged powdered coating onto the part, the coating metal is dissolved in liquid as "metal salts," and the electrical charge is run through the part itself to attract the metal salts particles to stick to it. The salts deposit themselves evenly on the charged metal of the part, delivering a uniform finish.

As with powder coating, your parts must be perfectly clean to get a good result with electroplating. Any impurities cause the plating metal to simply flake right off. Also, the surface to be plated must be etched, which creates microscopic irregularities so that the plating metal bonds to the substrate. Platers usually begin by depositing several layers of copper and then nickel onto the part. The copper fills pits and small imperfections before the shiny layer goes on. Once the silver or chromium has been applied, any imperfections in the underlying part show up and make themselves obvious.

Many metals may be plated onto the substrate, including the most common: chromium, gold, and silver. But copper, nickel, cadmium, zinc, and tin are used to achieve different effects and different resulting characteristics. For example, nickel plating is common among racers because it yields the same shiny metal finish as chrome, but unlike chrome, nickel plating does not hide cracks.

Cadmium is used for its excellent resistance properties to all kinds of corrosion, especially salt. Aluminum and salt are an exceptionally bad combination, because the salt induces a process called galvanic corrosion that holds the parts together while weakening the aluminum. Cadmium is not subject to galvanic corrosion. This means that cadmium offers both protection and longevity. Cadmium can also be plated onto threaded

fasteners without interfering with the ability to thread those fasteners together.

Chrome and other electroplated surfaces look fantastic, but you can achieve the same (or very close) effect with a good powder coating using metallic or translucent powders.

Cadmium Coated Parts

The tradeoff with using cadmium is that it is poisonous. Do not grind it or other-wise work it that might result in you breathing or swallowing any of it. This includes getting it hot enough to outgas in an enclosed environment, but the temperatures used for powder coating should be safe. Just remember to ventilate properly. Toxicity is another good reason to powder coat cadmium-plated parts: to seal in the sealant!

Cadmium plating also has an advantage in that you can powder coat the plated parts; the cadmium acts like a primer so that the powder sticks. This is useful because cadmium is not an especially dressy form of plating. The color is mostly an orange-yellow, with some sheen similar to oil floating on water. So a good coat of powder is an excellent choice on a cadmium-coated oil pan, valve cover, or other nonthreaded part.

For the amateur, electroplating is an awfully finicky process. Kits are available to do it yourself, but you have to be ready to apply multiple layers of base metal and then the critical final layer. This means that the process must be performed precisely. Home platers have had mixed results, and the expense, time, and potential for unsatisfactory results mean that electroplating is usually best left to professionals. This is especially true for cadmium because of its toxicity. The exception is copper or brass plating, which is easier, less expensive, and yields generally good results.

If you have a plated part that is showing flaws (most likely a chrome part), consider etching and powder coating as a way to salvage the project. Electroplating makes tiny flaws more obvious, while powder coat fills in the flaws and hides them. If you have a damaged or low-quality chromed part, strip off the plating and experiment with reflective chrome powder coat or another color, even clear powder helps.

Tinning

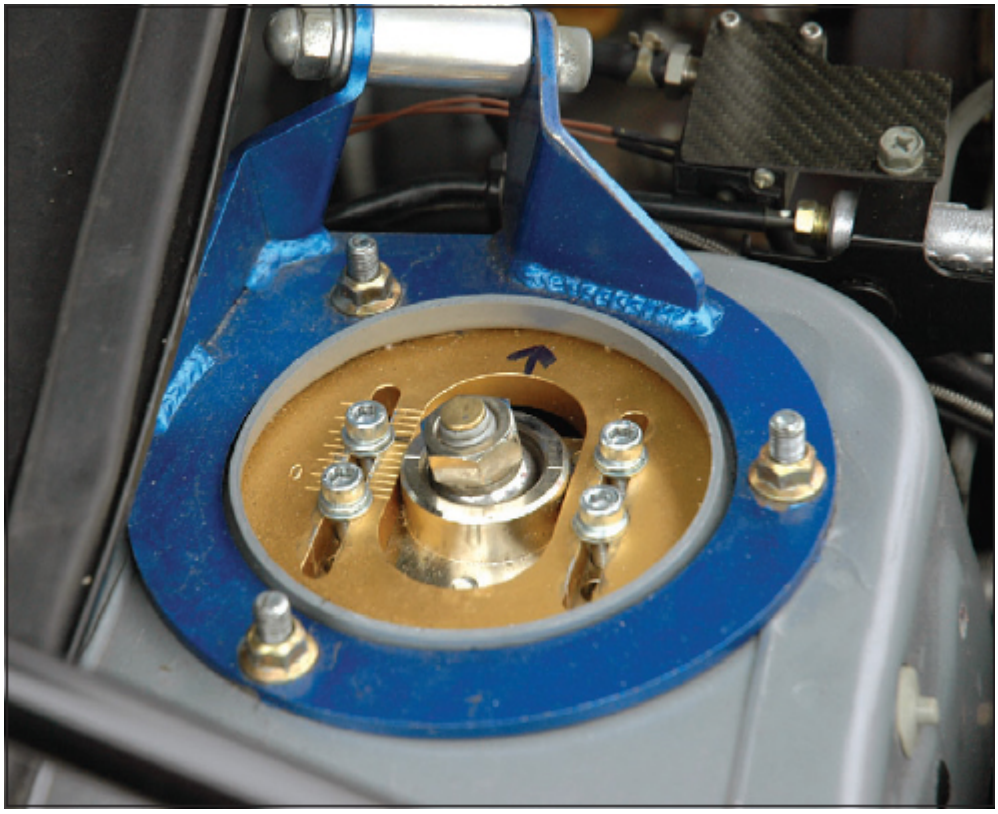
Tinning is coating process that is generally included with metal plating, although it works by much more traditional means. The part is simply dipped into hot, molten, pure tin, and the metal sticks to the part in a thick coat.

Tin is often used to protect and reinforce thin steel sheet metal before it perforates. If the metal is already perforated, the rotten sections must be cut away and new steel welded into place before the part can be tinned.

Because tinning produces a far thicker coating than electroplating, it hides flaws and still makes a great surface for powder coating if you want color instead of the metallic tin finish.

Anodizing

Anodizing is an alternative to powder coating although there are now powders that approximate the same visual effect. Anodizing is like electroplating in that electrical current is used to deposit oxides onto the surface of metal parts, especially aluminum. These oxides are beneficial in that they seal the metal and protect the base part from corrosion and wear. Some exotic metals may also be anodized, but none that are commonly used. Iron and steel cannot be anodized in the same way because the metal corrodes; however, they can be treated with acid for a similar effect.



Both the blue ring and the gold plate in this adjustable alignment setup are made of anodized aluminum for good looks and durability. Anodizing is performed on aluminum and other less common metals such as titanium.

Anodizing is similar to electroplating and powder coating in that electrical current is used to deposit material on the part. In this case, however, the material is an oxide of the base metal. This oxide protects the part and can be dyed any color.

Powder Coating Cracked Parts

Powder coat can hide imperfections, but it doesn't fix cracks in the underlying metal. If you coat over a crack, the crack continues to propagate until the part breaks. Murphy's Law says that will happen at the worst possible time. Never coat cracked parts, and any stressed parts (such as suspension components) should be crack-checked by a machine shop before coating.

Anodizing creates a thin film of the oxide on the surface of the part. This layer is not especially tough or hard by metal standards but is tougher than any paint or electroplated covering. One difference between anodizing and other coatings and platings is that an anodized surface is porous, and thus provides incomplete sealing against corrosive substances. For this reason, parts are often dyed to give the surface the characteristic "anodized" look. Additional sealants are also often used with anodized parts to protect them from corrosive agents; seawater is the most common.

Similar to cadmium plating, anodizing is popular for threaded parts because it does not hinder threading the parts together and helps resist corrosion that "rust welds" parts together.

How to Achieve Good Results

When it comes to doing things yourself, the satisfaction of a job well done cannot be matched. When others notice that your powder coating work has made your car, motorcycle, boat, airplane, even your kitchen into a unique piece of art, you will be justifiably proud. There are a few good rules to follow that help you enjoy the process and get results that will make you proud. These three rules are general advice that our parents and grandparents taught us, but they bear repeating.

Rule One: Play Safe

Safety must always be a primary concern when you're doing projects in your workshop. Powder coat is not generally toxic, but common sense tells you that inhaling powdered plastic with chromium in it is not good for your lungs. Similarly, handling hot parts can be hazardous, and all cleaning agents should be stored and used safely.

Some of the instructions in this book tell you how to wire a circuit and outlet for an electric stove for use with powder coating. If you're not confident of your ability to do this safely, there's no shame in calling an electrician to do it for you.

Perhaps most important, don't think that a gas oven works the same as an electric model; there is a danger of fire or even explosion with a gas oven. Only an electric oven can be used for powder coating.

Safety goggles are critically important when powder coating. Not so much because the process is dangerous as that powder makes your eyes red and itchy. If you're going to be working with cleaning chemicals and spinning wire wheels, you really need several sets of these goggles in your shop.

Rule Two: Learn About Your Equipment Before You Begin

You need to do some research before you get started. It's always tempting to plug everything in and go for it, but you waste far less powder and get more encouraging results early on if you read and follow all the instructions, at least for the first project or two, before you start.

It pays to do your homework. Learn what accessory supplies are available and consider the projects you want to do. Once you're into the project, you'll be frustrated if you have to wait a week while someone ships you the stuff you need before you can proceed.

Make sure you're using good air hardware and that you have an accurate and adjustable pressure regulator. Those mounted on compressors are notoriously inaccurate and hard to adjust properly. You can blow the cup fitting right off your powder gun if you don't have things set up properly.

This rusty hulk of a car is all potential. With the skills of a powder coater, you're well on your way to turning this kind of neglected junk into a work of automotive art.

If you know what you're supposed to be doing, you can use that as a baseline and then alter your procedures to work for your particular set of equipment and get the best results.

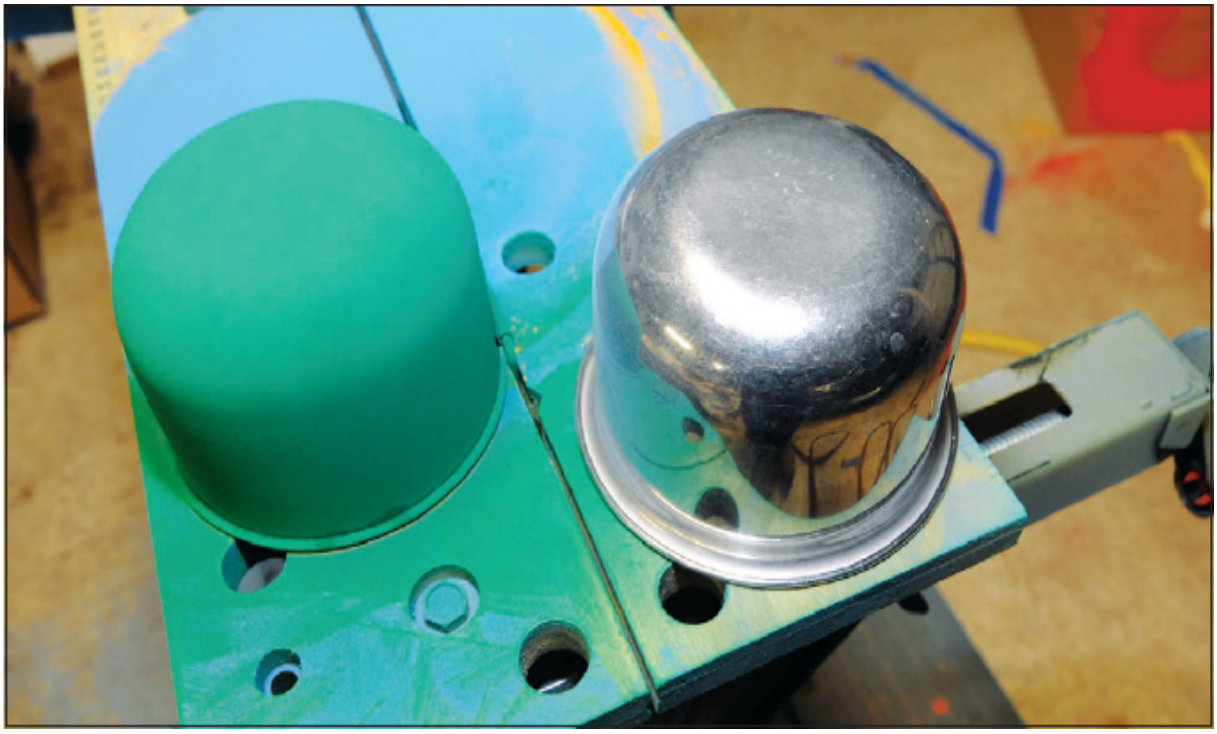
Rule Three: Have Fun and Don't Overextend Yourself

One key to a successful home project coating setup is to make sure you reward yourself from time to time. There's nothing more satisfying in a project than being able to see the excellent results you created by yourself.

You may find that once you start showing up with excellent powder coated parts on your car or other project your friends will turn up with all kinds of things to be coated. That's okay and maybe even desirable. But you should never let it become a burden, either financially or to your free time. Powder is expensive, and your time is valuable, so be sure that you account for both before you say yes to favors.

The last thing to say about having fun is that you should choose projects that keep the rewards of your work coming back to you, and that keep your enthusiasm strong.

When you're done, you will have powder coated parts all over your car, in places everyone can see, and others that may be invisible, but you know they're there and that they were done right.



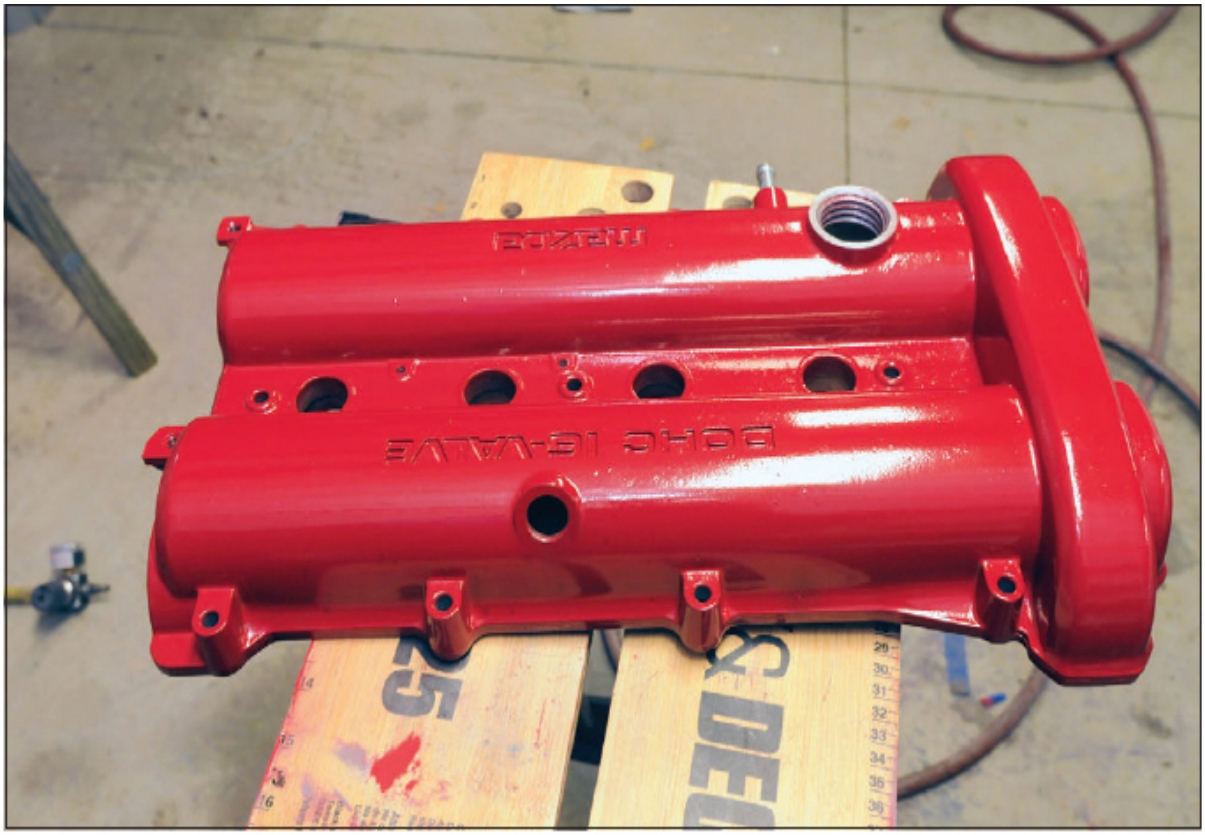
Powder coating can take the most ordinary set of stainless mixing bowls from a thrift store and turn them into colorful party servers, or just brighten up your washer and bolt storage system. The sky's the limit; what are you waiting for?

CHAPTER 2

CREATING A WORKSPACE

If you want to achieve good results with powder coating, there are a few requirements that are common to any workshop-based process, and a few things that are specific to setting up a successful powder coating shop. The difference between having and not having these things is not that you can't do the work, or even get good results, but rather that the work is more difficult and less fun, and your results are less likely to be good.

The first thing you need is a warm, dry, clean, and pleasant space to work, and that often requires a little effort. Your workspace should fit the work you plan to do as well as your own personal needs and comfort requirements. The main thing is to give yourself plenty of space for your projects and some elbowroom for yourself. You don't want to get powder all over everything you own; or worse, things that other members of your family own! You also don't want to knock things over or smudge your beautiful coating.



Before you embark on any powder coating project, you need to assemble the right materials and tools in your workshop. Great results don't happen by accident; rather, these are the consequence of excellent preparation and correct use of materials and tools.

So before you begin, take stock of your available space. It can be as simple as a prefab garden shed from a home supply store or as elaborate as a dedicated workshop with a professional-grade oven. It might even be a patio, and depending on your local weather, that can be a great option. But most likely, it's your garage or a freestanding workshop.

Infrastructure Requirements

The first thing to realize about powder coating is that it requires its own infrastructure. In addition to light, ventilation, and a workbench, you need compressed air. So plan on at least a small portable compressor to run your powder coat sprayer (see page 33 for more details). You also need a curing oven (see page 36 for more details).

Local Laws

Your local laws may have something to say about powder coating in your garage or workshop, especially if you live in an urban area. Powder coating has air-quality implications, and although there are generally allowances for amateurs, check your local laws.

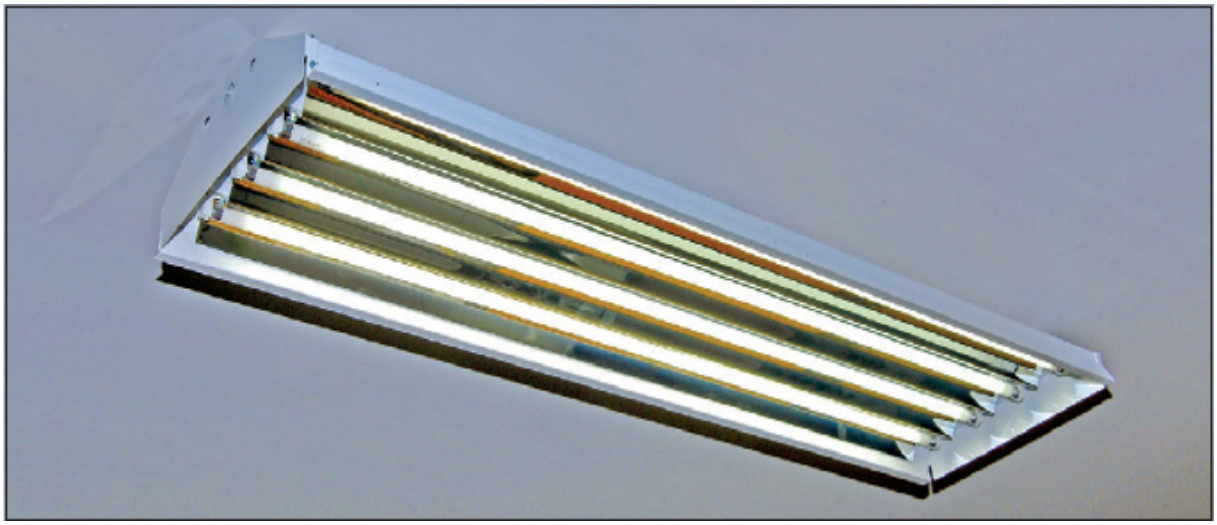
One of the handiest things you can have is a Workmate or similar work stand. It's easy to drag your powder coating transformer off the workbench or table as you coat. Simply use the vise function of the Workmate to capture the power cable and your coating transformer stays put.

If you don't have overhead lighting, find yourself some good shop lights that you can move around. As an added advantage, halogen shop lights help heat your shop in the winter.

A good workbench is invaluable as you clean, prep, and coat your parts. It can be an old kitchen counter, some sawhorses and an old door, or a custom-built workbench with a stainless steel top. As long as it provides a good work surface, you have what you need.

Electricity and Lighting

One utility service you absolutely need is electricity. A powder coating gun, air compressor, and curing oven all need power. Plus, you want some light so you can see what you're doing. Ideally, you have plenty of outlets to work with, and a clean, well-lit space for working. Paint your workshop floor, workbench, and walls in light colors to reflect light around the space while you work. This cuts down on shadowy places and helps reduce fatigue.



Good lighting is another important feature of a shop where you can do good work. If you can't see what you're doing, you will surely make unnecessary mistakes.

You need a lot of light to have a clear view of your coating work. The general light level that you need to change spark plugs won't do for powdering. Modern fluorescent fixtures provide a tremendous amount of light, and freestanding banks of halogen bulbs work well, too, although they tend to create a lot of shadows. Your best bet is a few four-tube fluorescent fixtures right over your work area.

If you don't have access to electricity to run an air compressor, powder gun, and lights simultaneously, you have to find a power source; nothing else will do. Curing is another challenge for the power-impaired; you need 120 volts for small items and 240 volts for larger pieces.

Ventilation

Adequate ventilation in your workspace is very important for good powder coating. You're going to be blowing a fine powder onto your work, but enough of it ends up in the air that you won't be able to breathe without good airflow.

The materials used in the making of powder are usually toxic to some degree. You need to bring fresh air into the powder booth and evacuate the dust constantly; when curing the powder, you need to evacuate the fumes. Powder is also generally flammable, so you need to make sure that fire

safety has been perfected, especially if you're sharing the garage with your household furnace or a water heater!

Once again, your best bet is to work outside, but a simple open door and box fan can keep things reasonably clear. See the instructions on pages 28 and 30 for building a powder coating booth to help keep your breathing air clean.

Another tool that may help is a carpenter's sawdust collector and extractor system. These are more expensive, but they are designed to suck up floating dust and either expel it from your shop or deposit it into a collection bag.

Regardless of the air cleaning system you use, always wear a good-quality respirator suitable for painting when you are working with powder coat.

Safety Gear

The first items on your shopping list should be your safety gear. This includes skin and breathing protection as well as eye protection. Powder coat is wonderful stuff, but you really don't want it in your eyes or your lungs.

Get yourself a top-quality respirator. The little breathable masks they sell for painting are okay, but only just okay. You won't want to wear them for a long time, and you'll be tempted to go without them. If you have a good-quality respirator with replaceable canisters, you'll feel better about wearing it. Similarly, get a good set of safety goggles that protect your eyes from powder in the air.

Buy a bottle of contact lens saline solution and keep it handy in your powder coating workshop. If you get dust or powder (or anything else) in your eyes, it's right there to flush out the foreign matter.

Another key safety item is work clothing. This keeps cleaning solvents and powder off your skin. You can get a box of nitrile or latex gloves to wear. Don't worry about changing them frequently and you don't need to invest in a set of nicer mechanic's gloves. Old pants and long-sleeve shirts are best to keep your skin clean, and a shop apron or shop coat is even better. Finally, a hat that covers all or most of your hair is a good investment.

A welder's bandana is shaped to tie around your head and keep your hair out of your project. These are inexpensive and work very well.

Of course, you also want a handy first aid kit. Even if you are always careful, it is wise to have some burn treatments ready. Similarly, you want to keep a good fire extinguisher (or two or three) around your shop, just in case.

You're going to be working with some nasty chemicals in the cleaning process. You really need gloves rated for use with caustic chemicals. You also need oven mitts.

Finding (or Building) a Good Workbench

Workbenches are an absolutely critical part of your workspace. You do a lot of careful work on a bench, so you want to be sure that it is at the optimum height for you (or whoever will be working there). Obviously, the optimum height for someone who is 5-feet 2-inches tall is different from the

height for a 6-footer, so spend some time testing benches of different heights to find what works best for you.

If you keep your eyes peeled, you may find a free workbench like this one. Also, craigslist has an extensive free section.

Doors for Workbenches

If you're looking for a smooth workbench top surface, look for used household doors. Interior doors are lightweight, but tend to be smooth on both surfaces. Exterior doors may even be metal-covered for maximum durability. Place the doorknob hole toward the wall to make a great route for the plug wires for your benchtop tools or appliances.

Workbench Height

Most kitchen counters are not as tall as you want for a workbench. To get a kitchen counter up to the right height, you should build a sturdy stand underneath. Depending on the height you need, this can be another place for storage or just a good way to keep your nice cabinets off the dirty floor.

Remember that you will work on some items from the top, and some from the sides, so you may decide that what you really need are a few different-height benches for different purposes.

Another important factor for workbenches is that they have to be rock solid. A wobbly bench is no bench at all. So make sure that your bench is heavy, attached to the wall, and solidly standing on the floor. Most workbenches are built in place for precisely this reason. As nice as a premade bench looks, they are generally lighter and designed to stand free. Unless they are well attached to a wall, they may move when you don’t want them to.

There really are no rules about how your workbench has to be made. You can create a serviceable bench out of free packing crates or purchase a used kitchen counter. Kitchen counters work well because they tend to have nice laminate tops built over particleboard, so you can mount bench tools to them, or work directly on the surface. You can visit your local recycled building supply store. Habitat for Humanity has ReStores across the United States and Canada with salvaged and donated home supplies at extreme bargain prices. These stores generally have a large supply of used counters, breakfast bars, doors, and other resources.

Another reason that kitchen counters work well as workbenches is that they generally come with a useful combination of drawers and cabinets built underneath, and you can often find matching wall cabinets at the same time in the same store. Your shop can have a finished look as nice as the inside of a house for about the same price as building a bench out of lumber.

Project: Low-Cost Heavy-Duty Workbench

The classic workbench is a heavy-duty item, built in place and securely mounted to the wall. This kind of bench is great for mounting tools, such as a drill press, bench grinder, or hydraulic press, and it's also a great place for general tasks.

This project uses inexpensive 2 x 6 stud lumber and some 1/2-inch plywood for the benchtop. It is painted white for good light reflection and a clean look. Brand-new white paint at very low cost is often available at a recycled building supply center.

This benchtop is 42 inches above the floor, which is a good height for a tall person, but likely too tall to be comfortable for shorter people. In general, 36 to 40 inches is a good height. If you are tall enough to use a higher benchtop, you can put a large storage shelf or set of cabinets under the bench.

This project bench is 12 feet long, but you can build it shorter or longer by simply adding more supports and more boards. Just make sure the bench is supported every 6 feet.

The bench is 30 inches deep, which is five 2 x 6 widths with a small gap between each board. Additionally, there is a shelf 24 inches above the floor level; this shelf uses four 2 x 6 boards nailed in tightly to extend 22 inches from the wall. This provides a useful shelf while being recessed far enough to avoid hitting your shins. It allows you to sit on a stool and work with your knees under the bench.

Project Details

Cost

About $100 in wood and hardware

Time to build

About 4 to 6 hours

Tools
Circular saw
Hammer and nails or power driver and screws
Carpenter’s level
Measuring tape
Supplies
9 12-foot 2 x 6 boards
16d nails or 3-inch heavy construction screws
1½-inch heavy construction screws
1 4 x 8–foot sheet of 1/2-inch CDX plywood

Follow these steps:

1 Plan your wall attachments. If you have vertical posts, you can attach the bench to the sides of the posts. But if you have smooth walls, you can cut an extra support and screw it to the wall. If the span between vertical posts is more than about 8 feet, you should plan on an extra support screwed to the wall.

2 Cut the outer legs 2 inches shorter than the height you want for your benchtop. In this case, I cut the outer legs to 40 inches. This is a little less than half of an 8-foot board. The 40-inch height accounts for the 1½-inch height of the 2 x 6 boards on top of the supports, and the 1/2-inch plywood surface to create the total 42-inch height of the bench.

You can build a custom workbench in your shop or garage for the price of some 2 x 6 lumber, and you can make it as tall or short as you like. This design delivers a super-strong bench perfectly suited to powder coating.

3 For each set of supports you need one outer leg and one inner leg (if you do not have a building post or other sturdy wall attachment point). For this project, cut two outer legs at 40 inches long for the two post supports, and four more legs at 38½ inches for the two mid-span supports.

4 Next, cut eight horizontal supports at 30 inches each. Two of these go in the corner at 40 inches and 22 inches off the ground to establish the bench and shelf heights. You might need to build an additional end support if you don't have a good corner to work with.

5 Screw a horizontal support on each side of each post, 40 inches off the floor, and two more horizontal supports 22 inches from the floor. The horizontal supports attach to an outer leg, placed parallel to the post.

6 The mid-span support uses a lighter design, and you can use this design for all the supports if you do not have posts to work with. First, screw a 38½-inch board flat against the wall. Then stand another 38½-inch board at the outer end as a leg; screw a single horizontal support flat on top of the two boards. For the shelf, screw another support to both vertical boards at 22 inches off the floor.

Good supports are critical to making a stable workbench. When you're done, this workbench should bear any weight you can lift onto it.

7 With your framework in place, simply lay out the shelf boards and the top boards, and nail or screw them into place. These boards firm up your structure and hold everything in place. If you have posts, you need to cut the boards that are against the walls a little shorter to fit between the posts. You might want to notch the innermost shelf board to get around the mid-span wall supports. The top takes five boards spaced out with a small gap between each one. The shelf takes four boards, placed tightly together.

8 A sheet of plywood cut into three pieces of 48 inches by 30 inches covers a bench 12 feet long. Cut those pieces and screw them to the benchtop for a smooth working surface. Remember that CDX plywood has a smooth side and a rough side. Be sure to position the smooth side facing up. If you have posts, you need to notch a couple pieces of the plywood to fit around each post. Be sure to screw the plywood to the boards every 2

feet, and in the center as well. Each piece of plywood takes nine or more screws for a solid installation.

When the top shelf has been made of 2 x 6 lumber, put a sheet of 1/2-inch plywood on top. It provides a smooth surface and ties all the lumber together.

9 Finally, paint the workbench. It helps reflect light, it looks great, and it helps seal the wood against spills.

When your bench is done, paint it to protect it from moisture and spills. If you paint the bench white, it reflects light around your shop and helps you see your projects. Plus it just looks great.

You can alter the dimensions of this project to fit your needs, but the basic design is strong and lasts for decades. You can replace the plywood if it gets damaged over time, and the basic structure won't be harmed.

Workbench Coating

You might want to paint your workbench with polyurethane pickup truck bedliner coating. This material is super-tough and stands up to all kinds of punishment. You can buy it by the quart at auto parts stores and apply it with a roller just like paint.

Protect Your Surroundings

If you're like most people you don't have a separate space in which to undertake powder coating, or to handle cleaning and prep. Preparing for powder coating and then performing the work is a messy business, with lots of dust and overspray involved.

At a minimum, you want to cover absolutely everything in your garage or workshop with plastic drop cloths. These are inexpensive at a home supply store, so buy more than you think you need. Be sure to tape down the edges; powder has a way of getting on everything in the vicinity. If you're working in the same garage that houses a car or your home's laundry facilities, you need to be extra careful to protect the areas and items you don't want to powder, or better yet, move the project out of that space entirely.

Building a Powder Coating Booth

Powder coating is a fairly messy proposition because you're using a compressed-air spray gun to deposit the powder on a charged metal item. Just like using paint, your powder is going to get into places other than the intended surfaces. Because you're likely working in a space shared with

other purposes, you need to control that overspray. The main point is to keep the powder dust from getting all over everything, which happens if you don't separate your powdering area from the rest of your shop! Overspray when powder coating is simply a reality you will have to manage.

The best thing you can do is to perform your spraying outside. Even then, it's wise to be cognizant of what's downwind. However, for many of us, through many months of the year, working outside is just not feasible. In that case, your next-best option is to create a powder coating booth, or several booths, for work of different sizes.

Project: Benchtop Powder Coating Booth

A simple benchtop box is suitable for powder coating smaller items up to 25 inches on a side. The size is equal to the amount of space in a standard kitchen oven, which is what most of us use for curing the powder.

This project was built using 3/4-inch Schedule 40 PVC pipe and fittings, plastic sheeting, a standard household furnace filter, and a basic household box fan. You can assemble this structure with PVC cement and make it more or less permanent, but the pieces hold together just fine without the cement, and then you can disassemble the whole thing quickly. Also, changing the size of the box is simply a matter of cutting the pieces of PVC pipe to the desired length.

You will likely need to purchase the side-outlet 90 corner fittings from an online vendor. Your local home supply store probably will not carry these, as most of them are "furniture grade" and not National Sanitation Foundation (NSF) rated for plumbing use.

Project Details
Cost **$40**

Time to build

60 minutes

Tools

Hacksaw

24-inch household box fan

Supplies

8 “side-outlet 90” corner fittings (three-way) in 3/4-inch PVC

3 10-foot lengths of Schedule 40 PVC pipe

1 heavy-duty 3.5-mil plastic drop cloth

Duct tape

25-inch-square furnace filter

Follow these steps:

1 Determine the size of the box you wish to build. It will be stronger if the spans are shorter, but anything up to a 3-foot cube is absolutely stable. For this project, the box is 25 inches tall, 25 inches deep, and 37 inches wide. This is large enough to coat valve covers, suspension parts, a mailbox, or a small automobile wheel up to about 15 inches in diameter with plenty of space to work.

2 Cut the height and depth lengths of PVC from your 10-foot lengths. Cut eight 24-inch lengths of pipe and four 36-inch lengths. You will get all of the pieces out of three 10-foot pipes by cutting two short and two long pieces out of two 10-footers, and then four more short lengths out of the third. You will have one 24-inch length left over.

If you plan to coat small items, consider making a framework of Schedule 40 PVC pipe and wrapping it in plastic sheeting. This helps keep overspray to a minimum.

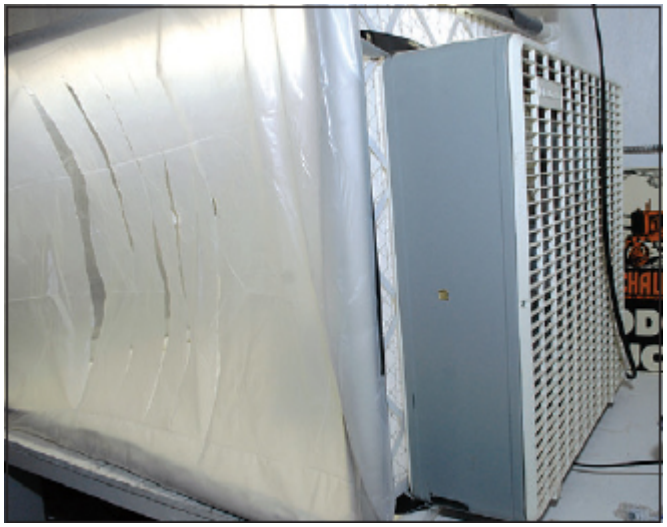
3 Place four side-outlet 90s at the corners of your work area. Put the width and depth spans of PVC pipe in place to make the base rectangle of the frame. Build the top rectangle the same way, using four more side-outlet 90s. Then install the vertical posts and place the top frame on the posts.

Side-outlet tee fittings, such as this one, generally have to be ordered online. Home supply stores usually don't carry them. Luckily, they cost about the same as plumbing fittings.

4 Cut a section of plastic drop cloth sufficiently large (100 x 60 inches) to wrap around the long axis of the structure and enclose one end. Next, position one corner of the plastic at a corner of the structure; the plastic overlaps the opposite corner by a couple of feet. Tape the edge of the plastic to the frame and wrap it all the way around and tape the plastic sheet to itself. You should have about 4 inches of overlap. Then trim the overlapped end so that only one sheet of plastic 25 inches square can be taped over that end. Leave the other end open for now.

With a little duct tape and a plastic painter's drop cloth, your framework becomes a little paint booth. A few slits in the front face, or a flap, let you get your parts and powder gun into the coating booth.

5 At the open end, use duct tape to attach a 25-inch-square furnace filter in the opening. This size of filter is unusual enough that a grocery store probably doesn't have one, but any home supply store does. Place a box fan with the intake side against the filter and duct tape it in place. The idea is for the box fan to suck air through the furnace filter and out of the powder box.



A fan with a furnace filter helps trap overspray. A simple inexpensive fluorescent light on top of the box lights everything inside perfectly.

6 Cut a series of slits 2 inches apart in the front face of the sheeting for air intake and access. You can fit objects that are quite large through the sheeting this way, as well as get your powder and your hands into the box and still prevent most of the powder from escaping. For items too large to fit through the slits, simply detach the filter and slide the item in through the end (then reattach the filter).

7 Turn on the fan; it should create a slight vacuum in the box; about .1 psi. It should move enough air to suck the plastic inward a bit. Put intake holes in the opposite end if the fan is struggling or making it hard to work.

8 Place a cool fluorescent light over the top of the box. The plastic is translucent, so it disperses light very nicely. (You can also use this powder box as a photographer's light booth).

You can replicate this design in virtually any size, but since box fans are generally 20 to 24 inches square and the 25-inch air filter size makes a useful space, this size works well on most workbenches. Moreover, if you're using a standard size oven, you won't be able to cure items much larger than this anyway. The plastic is easily replaced when it gets dirty.

Project: Large Powder Coating Booth

This project creates a simple and lightweight powder coating booth suitable for coating larger items inside your garage or workshop. This booth is certainly suitable for shooting a coat of powder on any part, especially those that you need to walk around to give full coverage. The best part is that it is very easy to put up this hanging-curtain booth and take it down again later. You get protection while you're blowing powder and it doesn't take up your space permanently!

This project specifies 3/4-inch Schedule 40 PVC pipe because the example shown here was built in a workshop and was well supported from the ceiling, but you could use Schedule 80 PVC, thin-wall metal conduit, or even metal fence pipe of the same outer diameter for more rigidity to build the project as a standalone. Be sure to weigh down the legs with concrete construction piers if you build outside, though!

As a rule, the larger the pipe's diameter, the stiffer it is. PVC has the advantage of being lightweight and cheap, plus you can always use it for plumbing afterward. As with the previous project, you have the option to cement the joints to make it permanent or skip the cement so you can break it down and bundle up the pipes.

Project Details

Cost

$60–100

Time to build

60 minutes

Tools

Hacksaw
Power driver and screws
24-inch shop fan
Supplies
4 side-outlet 90 corner fittings (three-way) in 3/4-inch PVC
2 side-outlet tee fittings (four-way) in 3/4-inch PVC
13 10-foot lengths of Schedule 40 or 80 PVC pipe
4 heavy-duty 3.5-mil 10 x 25–foot plastic drop cloths
10 to 20 carpenter’s spring clamps
Duct tape
3/4-inch pipe supports
25-inch-square furnace filter

Again, you can purchase side-outlet 90 corner fittings and side-outlet tee fittings from an online vendor, as your local home supply store is not likely to carry them. The fittings used in this example came from flexpvc.com and cost less than $30, including shipping.

Side-outlet tee fittings are another special-order item. At just $1 or $2 each, there's no reason not get a good supply of them for constructing whatever kind of booth you need.

Changing the size of the structure is simply a matter of cutting the pieces of pipe to the desired length. The smaller the structure, the more solid it is. You can make the booth stronger by purchasing more side-outlet tees and making shorter spans. An alternative is to buy twice the number of side-outlet 90s and side-outlet tees, more lengths of PVC, and tie the top and bottom of the structure together.

Follow these steps:

1 Determine the size of the booth you wish to build. You have enough junctions for a booth 10 feet wide, 10 feet tall, and 20 feet long using 13 10-foot lengths of pipe. However, the booth is stronger if the spans are shorter.

2 Place the side-outlet 90s at the corners of your work area. If your work area is outdoors and it's windy, tie the structure to concrete construction piers to keep it from blowing away. Put the width and length spans of PVC pipe in place to make the top of the frame.

3 Schedule 40 PVC is quite flexible, so if possible build this powder booth in your garage or workshop. Tie the upper frame to the ceiling using standard 3/4-inch plumbing pipe supports, which are attached with two construction screws each. Put the screws in loosely at first, so you can move the pipe and get the plastic sheeting over it; tighten the screws when everything is ready.

To make a larger booth, attach some of your Schedule 40 (or Schedule 80) pipe to the ceiling of your garage or shop. You can hang plastic sheeting from these pipes to keep your powder overspray under control.

4 Put the legs onto the structure, one side at a time. If you're anchoring the frame to construction piers, stick the bottoms of the legs into the holes in the piers and shim the legs firmly in the holes with soft wood shims. If the upper frame is attached to the ceiling, insert the legs as you go. If the ceiling is less than 10 feet high, you may need to cut the pipes to fit. The fit should be good and solid, because the legs also hold down the bottom edge of the plastic booth walls.

You can pin the bottom edge of your plastic sheeting to the ground by using a vertical piece of PVC pipe standing on it. A good solution doesn't have to be complicated!

5 Cover the structure with plastic drop cloths, using spring clamps or duct tape to affix the plastic sheeting to the structure. The exact method of attachment depends on the size of the structure and the size of the sheeting. Be sure to anchor the sheeting under the legs and concrete piers.

Use inexpensive spring clips from the home supply store to attach the plastic sheeting to the PVC pipes near the ceiling and on the vertical posts of your coating booth.

This booth is big enough for a car. But unless you have an unusually large oven for curing, powder coating an entire car is probably outside your capabilities at home.

6 For ventilation, cut a hole in the sheeting at one corner and duct tape the furnace filter to the intake face of the shop fan. Place the fan in the hole and duct tape the sheeting to the box fan. The idea is for the box fan to suck air through the furnace filter and out of the booth. You can allow fresh air to come in through slits in the sheeting or place another furnace filter over a hole for air intake. The fan should create a slight vacuum in the booth to move air through (about .1 psi).

7 For a really fancy setup, use tees, elbows, and a little more PVC pipe to create a frame for the box fan at the bottom of a leg brace.

When the paint booth is finished, it does not impede breathing air getting into the booth, but contains powder overspray very well. Put another dropcloth on the ground and you can simply collect your overspray and put it in the trash.

Compressed Air

Powder coating requires compressed air at about 5 to 10 psi; that's not much when most compressors are designed to deliver air at approximately 90 psi. You're going to need a low-pressure regulator with any compressor you buy. These can cost from about $20 to well over $100. You can use a less expensive model that adjusts down to 5 psi, but these are often less

accurate in their pressure delivery. Use a pressure gauge to ensure that the pressure is not too high.

A much bigger decision is what kind of air compressor to get. If you don't already have one, you have some shopping to do. If you're thinking strictly about powder coating, you can buy a small compressor that can fit under the workbench. These are affordable, they work great for light duty, and they plug into a standard 120-volt outlet.

You don't need a big compressor to run a powder coating system. Most guns work with 5 to 15 psi, so even a small compressor is more than

adequate.

Small compressors are fine for powder coating, but they can't do much more than fill a tire, use an impact wrench, or run a spray gun on a light-duty cycle. It's not realistic for one to power a blast cabinet for parts cleaning or something big such as a tire-mounting machine. Getting a larger compressor involves more expense and work to install it in your garage, but if you plan (or hope) to use more serious tools, you'll never look at your big compressor and wish you'd bought something less powerful.

Compressor Size

The first step is to figure out how much compression you really need, and then get a compressor that comfortably meets your needs. To figure out the size and power of the compressor to buy, look at the cubic feet per minute rating (CFM) and the maximum pressure in pounds per square inch (PSI). This figure is usually printed on the compressor and should be included in the machine's advertising and literature. In addition, look at the tools you want to run and think about how frequently you plan to use them.

When you go compressor shopping, you will notice right away that compressors are frequently rated and sold based on their horsepower, which is a misleading statistic. Bear in mind that the CFM ratings assigned by the manufacturer are generally optimistic. Moreover, the claimed rated CFM is actually the amount of air that the compressor sucks into the intake to be compressed, *not* the amount of air that comes out of the hose.

If you have the space, a big compressor is always a good tool to have on hand. You can run other air-powered tools and always have air to use.

You must also understand that the air usage requirement for most tools assumes a very light-duty cycle, which is to say, perhaps using air only 10 to 15 percent of the time. You can then see that if the compressor manufacturer is overstating the machine's ability to produce compressed air, and the tool manufacturers are understating the amount of air they actually need if you plan to use them intensively, you need some "overkill" on your compressor.

You should choose a compressor for your maximum needs. A freestanding abrasive cabinet designed for home shop use can require as much as 10 to 15 cfm at 80 or 90 psi. That calls for a 240-volt, belt-driven, 3.5- to 5-hp, 60-gallon vertical tank compressor, which you can get for about $400 at any home supply big box store. However, if you're just planning to use your powder coating kit and an air nozzle to blow out dust you can be perfectly happy with a 120-volt, 4-gallon, "hot dog"–style unit producing 3 cfm located under your workbench.

The bottom line is this: For any kind of serious automotive work with air tools, and absolutely if you're running an abrasive blast cabinet or other freestanding tool, you need a 240-volt compressor pumping more than 10 cfm with a tank of at least 60 gallons. When it comes to air power, buy as much compressor as you can comfortably afford and store in your shop. You will never regret going large.

A bewildering variety of compressors are available, but it's easy to choose a good one. Look for a recognized name brand with solid construction in the compressor machinery. These cost a bit more, but it is far less than replacing a cheap compressor every few months.

Compressor Location

The appeal of a small compressor is that it doesn't take up much valuable working space. But even if you have a big compressor, you don't have to let it dominate the garage. Compressors are noisy, so they are often placed outside the shop in a protected shed or in a well-insulated closet inside the garage. As long as the compressor's heat can't build up around it, an isolated space is great for a compressor.

All things considered, the best place for a compressor is outside. But a compressor is an expensive piece of hardware, so it has to be protected from the elements. A simple shed does the trick nicely. Plumb the air lines through the wall into your shop and leave the compressor on, or install a switch for it next to the shop's light switches. That way, you can fire up the air at the same time you turn on the lights.

One word of caution about putting your compressor outside: You might annoy your neighbors if it's a noisy unit and you use it a lot, especially if you like to work late into the night or if you leave it turned on and it roars

to life at 3:00 am. If your garage is near your neighbor and you want to put the compressor out back, be sure to build its shed with some fiberglass insulation to reduce the noise.

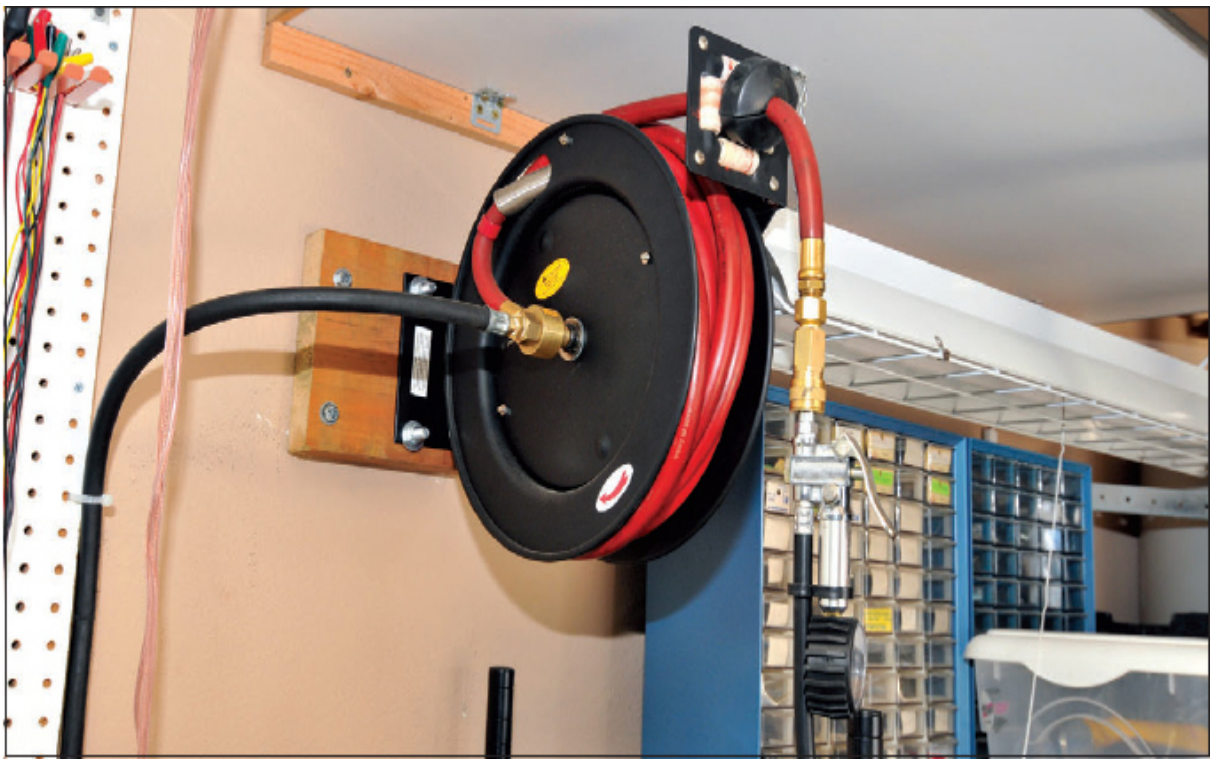
Air Line Plumbing

The easiest and cheapest air plumbing you can have is simply to attach the air hose to the compressor and coil it neatly when it's not in use. Just make sure that your hose reaches anywhere you want to work, including through the door of your shop and into the parking area.

Your air hose storage system can be as simple as a big nail in the wall, or a garden hose holder. Just have somewhere other than the floor to store it.

For an upgrade to the coil of hose on the floor, consider a hose reel. Even shops with a full hard-line air plumbing system often use a hose reel. This is simply 50 or 100 feet of quality air hose wound on a big spool. A connection is at the center to allow the reel to spin, and then a length of hose connects the reel to the compressor or air system. When you need the hose, just grab it and pull and then crank it back onto the reel when you're done.

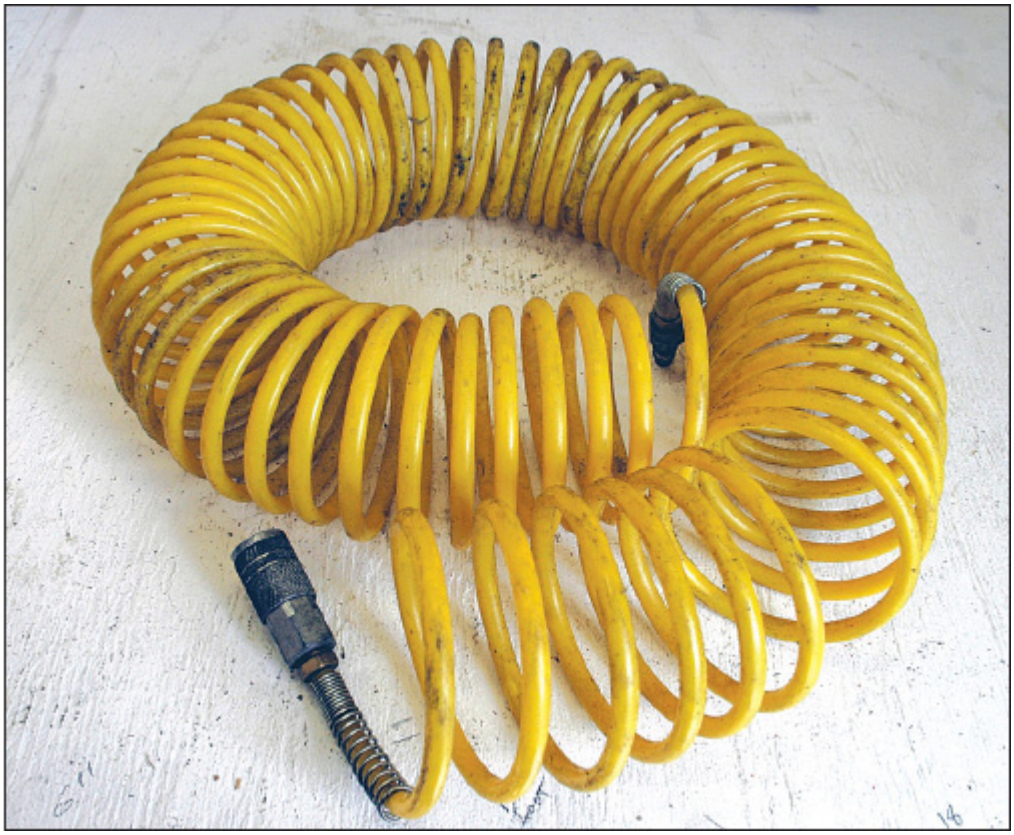
One expense that's worth the money is buying quality air hose. It will last for years or even decades. You can run over it with a car or brush it across hot metal and it takes the abuse. Avoid the coiled plastic air lines that are sold in bargain stores. That material is easily cut, burned, crimped, and crushed, and the end fittings often come loose. The exception is that you might want to have one or two cheap plastic hoses to use for jobs that you know might damage your good air hose.



A hose reel like this one costs about $40, and makes a neat and convenient storage system for your air hose. Plus, it looks professional.

A water collector is a must-have accessory to help keep your powder dry and your powder guns in good condition. Air compressors create condensation, so that air is always wetter than the ambient air in your shop.

Always buy the best hoses you can find for your air system. They don't cost much and give you decades of good and reliable service.



Cheap air hose costs almost as much as good hose, and is always kinking or breaking, and it doesn't flow as much air as a good-quality hose. Avoid them and get the good stuff.

Quick-Release Connectors

A question that everyone faces is what style of quick-release air connectors to use. Once you choose a style, you're locked into that style unless you replace all your connectors, so it pays to choose wisely. There's really only one good choice, and that's the standard Industrial Interchange style; it's the most common. Chances are, if you buy or borrow an air tool and it has a quick-release plug on it, it will be an Industrial Interchange style, and the same is true with other air sources.

Even within the Industrial style, there are substantial differences among fittings made by different manufacturers, and they don't always work well together. Failure circumstances range from a little extra air leaking to the

connection popping apart randomly. If you're just starting out with compressed air, buy a lot of couplers and a lot of plugs from the same manufacturer all at once, and use them for as long as possible.

The Industrial Interchange plug goes by various names, including Standard and Type D couplings, but if you look for 1/4-inch NPT plugs manufactured to military specification Mil-C4109, it's the right part.

Types of Curing Ovens

One fact you can't avoid in powder coating is that you need a heat source to cure your parts. The least expensive way to handle this is with a standard kitchen appliance. You can use a toaster oven for small parts, and a standard kitchen oven for items up to about the size of a steel automobile wheel. Beyond that, you have to look at an infrared curing station or send your work out to an industrial powder coating shop for curing. Professional cooking ovens (such as commercial pizza ovens) are fantastic if you can find one, but they are generally too large and expensive for home use.

Is it okay to use a gas oven? In this section, I mostly discuss electric ovens. That's because you cannot use a gas oven safely with powder coat at home. Loose powder has the potential to burn and cause a fire if exposed to open flame, so it's important to stick with electric.

Toaster Oven

A basic toaster oven handles small items, and has the advantage of being conveniently sized and extremely inexpensive. You can pick one up at any thrift store or garage sale in good condition for just a few dollars.

A cheap toaster oven from a thrift store or garage sale is the perfect tool for curing small powder coating projects. If it comes with the baking tray, that's great. If not, you need to make one from sheet metal or a cookie sheet.

Test Oven Thermometer

Invest a few dollars in a good oven thermometer. Buy this item new and run some tests to determine how close your oven's controls match reality. You may find that there's quite a difference! Some powders are very sensitive to precise curing temperatures so you need to ensure oven temperatures are accurate.

Powder Coating Trays

Visit Goodwill or garage sales and purchase a selection of cookie sheets, pie tins, and baking pans for use with powder coating. Those pressed-foil baking pans from the grocery store also work great. They're designed for a single use with food, but you can use them multiple times with powder coating, and even reshape them if necessary.

Buy the largest toaster oven you can find, and make sure that it comes with controls for baking. It must have a heating element below the rack and a temperature control. A “light to dark” knob doesn’t give you the temperature control that you need over time.

When buying a used toaster oven, be sure a broiler pan is included. You may or may not use it, but it’s good to have it in case you need it.

Kitchen Oven

A basic electric range or in-wall oven is the best tool for home powder coating of parts up to the size of wheels, suspension components, and engine parts. These appliances have the controls you need, the appropriate interior space, and the durability to last.

A standard 30-inch range has an oven about 24 to 25 inches wide and is 14 inches tall from the lowest rack to the broiler element. All range ovens are about 18 to 19 inches deep. Larger ranges are available, but are comparatively rare and always more expensive.

Built-in wall ovens separate from a cooktop are sized from 24 to 30 inches. A 24-inch oven actually is about 19 inches wide inside the oven, so make sure you're getting a 30-inch unit; they don't cost any more.

You may have to build a metal rack or brick stand to support a wall oven, while a range stands on its own feet. Plus, most ranges offer a storage drawer you can use for stands and hooks.

To acquire a kitchen range, just keep your eyes open. Read the Free Stuff section of your local craigslist, ask a local appliance store if they have any giveaways, or visit your local appliance-recycling center.

You can find a used electric kitchen range on craigslist or the classified ads; chances are good you can get one for free! A range with digital controls is best for accurate curing temperatures. Just make sure it works and heats up to at least 400 degrees F.

A standard 30-inch-wide kitchen range offers an oven space about 24 inches wide, 18 inches deep, and 14 inches tall. This is big enough to cure most automobile wheels and many larger parts.

In addition, a used home supply store, Habitat for Humanity ReStores, and others have extremely inexpensive appliances. You can also visit the appliance center at your local Goodwill or other thrift store, or just buy a range from craigslist. Any of these options should cost less than $100 for a functional range.

Before selecting a range, if possible, plug it in to test it. The standard appliance cord for a range is 4 feet long. You can find a 6-foot cord at a home supply store if you need it. If the plug or cord has been damaged, they are easy to replace.

If the range is self-cleaning, run it through a cleaning cycle to get rid of food or other material. You don’t need ashes from food getting on your work.

Modify Oven Racks

Clip the hooks off your oven racks. They help hold the rack onto the slots provided in the sides of the oven, but they require you to tilt the rack to slide it into position. If you do that, you're absolutely certain to lose your part and have to start over. You want to just slide the rack with your part straight into the oven.

Curing Techniques

If you plan to coat larger items occasionally, you may be able to do your own coating and then send the items to a professional powder coating shop for curing. Ask around. Many shops may decline to cure items they haven't coated, but some may take the work.

The real challenge in coating something yourself and then having it cured elsewhere is getting it from your shop to the curing oven without destroying or losing the powder. Once the electrostatic charge is turned off, the powder is just staying on your part because that's where it was applied. The slightest touch, a breeze, a raindrop, or just about anything disturbs the coating and rubs the powder off.

Unless you have a really good way to move the part to the curing oven without touching it or exposing it to wind and weather, it's generally a good idea to coat it and cure it at the same location.

Infrared Curing

One solution to the problem of curing oversize parts is an infrared curing setup. This is a set of infrared heat lamps that are usually articulated to allow you to position them around the part. You are likely to have to perform your curing in stages, and move the part or the lamps to get a good cure on every section of the project.

A set of infrared curing lamps cost about $500, but low-power 1,500-watt units can be obtained for as little as $199. They all plug into a standard 15-amp household outlet, but you may want to plug different lamps into different circuits if you're using more than one.

You need some space to set up infrared curing, even though the lights are designed to be placed just inches from the part to be cured. The lamps generate a lot of heat, so they need to be kept well away from cars, free powder, solvents, and pretty much everything you don’t want to cook. You must pay attention to what’s above the lamps as well as what’s around and below them. Heat rises and you run the risk of fire if you’re not fully aware of the area surrounding the infrared lamps.

Getting an even cure on all sides is critically important to getting good results. You have to move the part around to get it to cure evenly on all sides, so be careful not to disturb the powder distribution as you do so. If possible, try to move the lamps instead of the part to avoid damaging the uncured finish.

You can buy an infrared thermometer at any hardware store. This little device doesn’t cost much and is a super addition to your powder coating kit, whether or not you buy infrared curing lamps. It is also handy to ensure that heavy pieces have come fully up to temperature in the oven. You simply point the thermometer at the piece, pull the trigger, position the dot of laser light on the surface that is curing, and read the temperature on the back of the gun.

Another great tool is an infrared thermometer. Just point it at the part and pull the trigger. It puts a little laser-light dot on the part and tells you the temperature. This is great for determining if powder coat on heavier parts has come fully up to curing temperature.

Heat Guns and Halogen Lights

Another technique is to use a combination of halogen work lights and a standard heat gun to cure your work. This gets the job done, but it takes a long time and tends to be uneven unless you're very patient and methodical. First, use the halogen lamps to get the powder to flow; otherwise the heat gun just blows the powder off the part. Halogen lights get a small part up to approximately 225 degrees F. Then, when the powder has melted, you can use the heat gun to get the part hot enough to cure.

Remember, you don't want to set your workshop on fire, so be sure you're curing in a fireproof area, and never leave the heat gun unattended!

Do Not Expose Concrete to High Heat

Concrete can explode if it's exposed to high heat. What happens is that water soaked into the floor can flash into steam and send chips of concrete flying. Be careful when using a heat gun or infrared lamps on concrete, and be especially careful if your work involves welding on a concrete floor.

Heat guns can help curing along on bigger or unwieldy parts, as long as the powder has melted and flowed. Otherwise, the hot air stream blows the powder off your part.

Halogen shop lights are great for lighting up your work, and in a pinch they get hot enough to help cure a part outside the oven. If you can use your halogen lights to flow the powder, you can use your heat gun to finish the cure.

Project: Outside Oven Installation

One thing to think about as you install a powder curing oven is that the baking process is going to produce a small amount of fumes that you really don't want to breathe. If at all possible, you should move the baking oven outdoors. Keep this change in location in mind when you create the power circuit. Most kitchen ranges have a 4-foot cord; you can buy a 6-foot cord, but that's the longest cord available.

The best solution is to put your outlet near a door or window. Set the stove just outside and run the cable through the door or window when you want to use the oven. This allows you to create an easier wiring plan and save some money on a weatherproof outlet. You can unplug the oven when you're not using it. If this isn't possible, you may have to create an outdoor outlet for the oven.

Oven Cover

A slip-on outdoor gas barbecue cover works very well as a range cover. They often have drawstrings or Velcro straps to help them fit snugly, and they keep the rain off. Just use common sense and wait until the oven is cool before putting the cover on.

Here's a great safety tip: Always flip the circuit breaker for your range outlet to the OFF position when it's not in use, especially if the range is outside. It's just too easy to leave it on or accidentally turn it on. At a minimum, you get a huge electric bill if the stove runs for days, and at worst someone could get a serious burn.

Ovens should be level, so one of the main considerations when placing your oven outdoors is to create a level surface. In addition, most ovens are not designed to be outdoors; if your outdoor location is not well covered, you must arrange some kind of waterproof cover to keep rain, snow, and dirt out of the controls.

To install a curing oven outside, which is highly recommended, first level the site where you plan to place the oven and position some bricks or paving stones for the range to stand on.

If you're putting the range outside the garage or workshop door, it's best to place it on a level concrete slab. However, if you have grass or gravel, get some bricks, piers, or breezeway blocks and dig them a few inches into the ground. Some quick work with a carpenter's bubble level gets you close enough. It's also nice if the stove sits above ground level by an inch or two, just to keep it clean and rust-free.

Having a level site helps your oven maintain uniform temperatures in all parts of the curing space. Spend a little time with a level and a trowel to get it perfectly level.

Once the range is in place, you can use a level to adjust the feet on the bricks. In addition to maintaining even temperatures, your installation will look nicer and less like a junk oven in your backyard.

Electric Range Power Cable

New power cables are available for an electric range. They come in 4- or 6-foot lengths, but no longer than that. If you sourced a used range, take a good look at the power cable; it is most likely cracked or damaged. A replacement is only a few dollars and well worth the money.

Installing a new, longer power cord on your range is a good idea. You should place the outlet for your range indoors, and the cord must be long enough to reach that outlet.

Be sure your range is wired properly and that the power cable is new and not damaged or cracked. Old ranges often have cables in terrible condition.

Wiring a Circuit for Your Curing Oven

When it comes to dedicated circuits, and especially 240-volt circuits, you must always read the owner's manual or the sticker on the side of the appliance to determine the current requirements and plan accordingly. For example, a modern kitchen range with oven requires a 50-amp 240-volt circuit. That circuit requires 6-gauge copper wire, and most 240-volt circuits use two 120-volt hot wires and a neutral wire, with an additional bare copper ground wire. You can run nonmetallic (NM) cable, often known by the trade name Romex. An alternative is to install conduit and pull individual wires through it.

NM cable is much easier and less expensive to run than pulling wires through conduit, and the junction boxes are plastic and can be nailed to the studs. However, if you are running circuits on the surface of an existing wall, you need to use metal (electrical metallic tubing, or EMT) or PVC conduit with individual wires or metal-clad flexible cable to meet codes.

If you are retrofitting or upgrading an existing garage, you may have old wiring already in place. Depending on the age of the installation, this could be ungrounded "knob and tube" wiring, or early cloth-covered nonmetallic cable. You can work with this kind of wiring, but you need professional advice or a book specifically dedicated to dealing with "antique" electrical service. To create a modern workshop, you're better off removing all that old stuff and running new wire for all your needs.

Electricity is the most useful service available to you, but it is also the most dangerous service to install and work with. You can be killed if you're not careful with your wiring, or you can set your garage full of cars on fire. Always use proper work methods, adhere to the

building and wiring codes, and, most of all, use common sense when working on your wiring.

Electrical Permits and Inspections

Before you start running wire and installing circuit breakers, you must determine if the project you have in mind requires any building permits and inspections. Generally speaking, you are required to obtain permits and inspections even if you're simply running a new circuit from an existing house panel, such as in an attached garage.

You almost certainly need permits and inspections if you are running a new sub-panel from your main service to a detached garage. You absolutely must obtain permits and inspections if you are setting up a new meter and main circuit panel for your shop, regardless of whether it is attached or detached. Utility companies will not install a meter and connect to your main circuit panel without a permit and official inspection.

Depending on your municipal rules, you may be legally required to obtain a permit just to install a garage door opener. After speed limits, this is probably the most widely ignored law in the country. Check with your local planning department to be sure of any requirements.

If your project requires permits and inspections, here's how it goes: You go to the city or county offices that govern your site and fill out the permit paperwork. It's usually a formality, and some municipalities now let you submit permit requests online. You pay the fee and they issue the permit, which you post on the building. You must do this part before you begin work. Note that the permit process may be slightly different for you as a homeowner doing your own work than if you engage a contractor. ■

Project: 240-Volt Range Outlet Circuit Installation

This project shows you how to wire a new outlet for a standard 50-amp 240-volt kitchen range with 6/3 NM cable. This cable has three insulated wires. Black and red for hot, white for neutral, plus an extra, uninsulated copper ground wire.

For this project, I assume that you have a main circuit panel or sub-panel in your workshop or garage, and that service is activated. If you are building a new shop or garage, you must have a service panel in the shop before starting this project.

These are the supplies you need to wire a new 240-volt circuit with an outlet for your curing oven. Total cost is about $65 for all-new materials, and you can do the job yourself in about an hour.

Project Details

Cost

$65

Time to build

About one hour

Tools

Framing hammer

Flathead and Phillips screwdriver
Carpenter’s pencil or Sharpie marker
Power screwdriver/drill with a wood-boring bit of at least 3/4 inch
Wiring pliers/strippers
Supplies
Lengths of NM cable (6/3 gauge) sufficient to span the distance you need
“New construction” receptacle box
Plug receptacle, fixtures (as necessary)
Roll of electrical tape
Circuit breaker of appropriate amperage for your wires and designed for your panel

The big advantage with NM cable is that you don’t have to buy and install conduit (which also means you don’t have to bend conduit and attach corner pieces). The electrical code allows you to simply drill holes through studs and route the flexible NM cable through the holes to your fixtures. Plus, the junction boxes and outlet boxes can be plastic because NM includes its own ground wire.

Nail guards to protect the wires should be used when NM cable is routed through studs. These are metal plates, or sometimes little cylinders

that go through the studs to keep future workers from driving a nail through the NM cable. Nail guards are generally required by code if your pass-through holes are less than 1¼ inches from the outside of the stud.

You can generally purchase supplies labeled “for new construction” for any NM cable project. They are designed to work with NM cable, and to be quickly and easily installed in an open-stud wall. In fact, codes require that NM cable be concealed for protection because its plastic sheath doesn’t provide much protection against puncture or abrasion. NM cable and its boxes are designed for installation behind sheetrock or OSB/plywood.

NM cable is available in several varieties of sheath: a gray version called UF (or direct burial cable) for buried or outdoor installation and two white versions as well as a white sheath for whether or not your installation might be subject to moisture.

Follow these steps:

1 Carefully plan and measure your circuit from the panel to its end. Note where you will install the outlet, and the type of box you will need. Use the pencil to mark where the circuit will go on the walls or ceiling. Measure and make note of all distances.

2 Lightly tack each fixture in its desired position; use the drill to make holes in the studs as necessary to thread the NM cable from the panel to the outlet box. Run the lengths of cable now. Make sure the cable is secured with cable staples or supports no more than 12 inches from each box unless the hole in the stud is within that 12-inch run.

3 Attach the fixtures firmly and run the cable into the outlet box. Leave the outlet box open with the wires hanging out. You can now request your rough inspection.

4 Once your work is inspected and approved, connect the wires to the outlet. If you need to connect bare wires to each other at any point, use screw-on wire nuts and wrap the connection solidly with electrical tape.

A dedicated circuit for your curing oven helps protect the electrical system, and you can turn the circuit off at the breaker panel when you're not using the oven.

5 Close the outlet box and go to the circuit panel. Make sure the power is turned off at the main breaker. Install the new 240-volt circuit breaker and label it on the panel. Attach the cable or conduit to the side or back of the panel and route the wires to the circuit breaker and to the neutral and ground bus bars.

Label the new circuit when it's complete, so you can easily flip that breaker when you're not curing. You don't want to accidentally leave the oven on for a week.

Close the panel and reset the main breaker. Turn on the breaker and test your new circuit by plugging in and turning on the oven.

CAUTION: Always stand to one side of the panel when turning on a breaker in case there is an unknown fault in the panel. If the breaker trips when you turn it on, you have a short somewhere in your work. Turn off the whole panel and disconnect the new circuit completely (hot, neutral, and ground) before you begin looking for the problem.

Curing Racks, Supports and Hangers

The process of curing powder coating means that the powder melts and flows together to create a strong finish. So, it stands to reason that when you place the item in the oven, you cannot just set it on a pan or a grille. The part would end up being glued to the pan and, worse, the finish is damaged. Therefore, you need to create supports to hold the new finish off the hot surfaces in the oven while it cures.

In most cases, you have at least one side of any powder coated piece that isn't coated, or it's already cured and you can set it on that side. But you may need to support or suspend a part in a way that gravity doesn't assist you, and that's why you end up making all kinds of tees, jigs, threaded stands, and hangers to suspend pieces in the oven.

You also have to create similar stands and racks to use to shoot the powder evenly on the parts. Spraying stands may be made of wood, cardboard, Styrofoam, or whatever you have on hand. But the curing stands must survive oven temperatures. That limits you to metals and ceramics, because the 400 to 450 degrees F required to cure most powders will set wood and paper on fire and melt or ignite plastics and petroleum-derived materials.

Make some S-hooks of different sizes and shapes out of wire fence clips or an old coat hanger. These are handy for hanging your work when you're spraying powder coat, or for hanging your work in the curing oven. You can attach the hooks to the broiler element or its supports.

As you take on different projects, you need to create some custom oven supports, so start thinking now about the materials and shapes you're planning to coat and how you might support them in the curing oven.

A spool of safety wire comes in handy for hanging projects and hundreds of other uses. Many Eastwood accessory kits come with a spool of wire in a convenient dispenser.

Project: Custom Oven Stand

This project creates some generally useful stands and racks for curing powder coated items. Be aware that you might need to make custom stands or hangers for any particular item you coat, but if you have a good selection of the basics, you'll know when you need a custom stand, and you'll have a good idea of how to make it. For this project, I picked an actual powder coating problem that I faced in the course of research for this book.

You use a rack or hanger because it is subjected to 450 degrees F and must withstand that temperature for as long as it takes to cure the project. So you can't make them out of anything that burns or melts or otherwise fuses to the coated item.

Project Details
Cost

$5 to $10

Time to build

About 5 minutes

Supplies

Some heavy wire fence clips

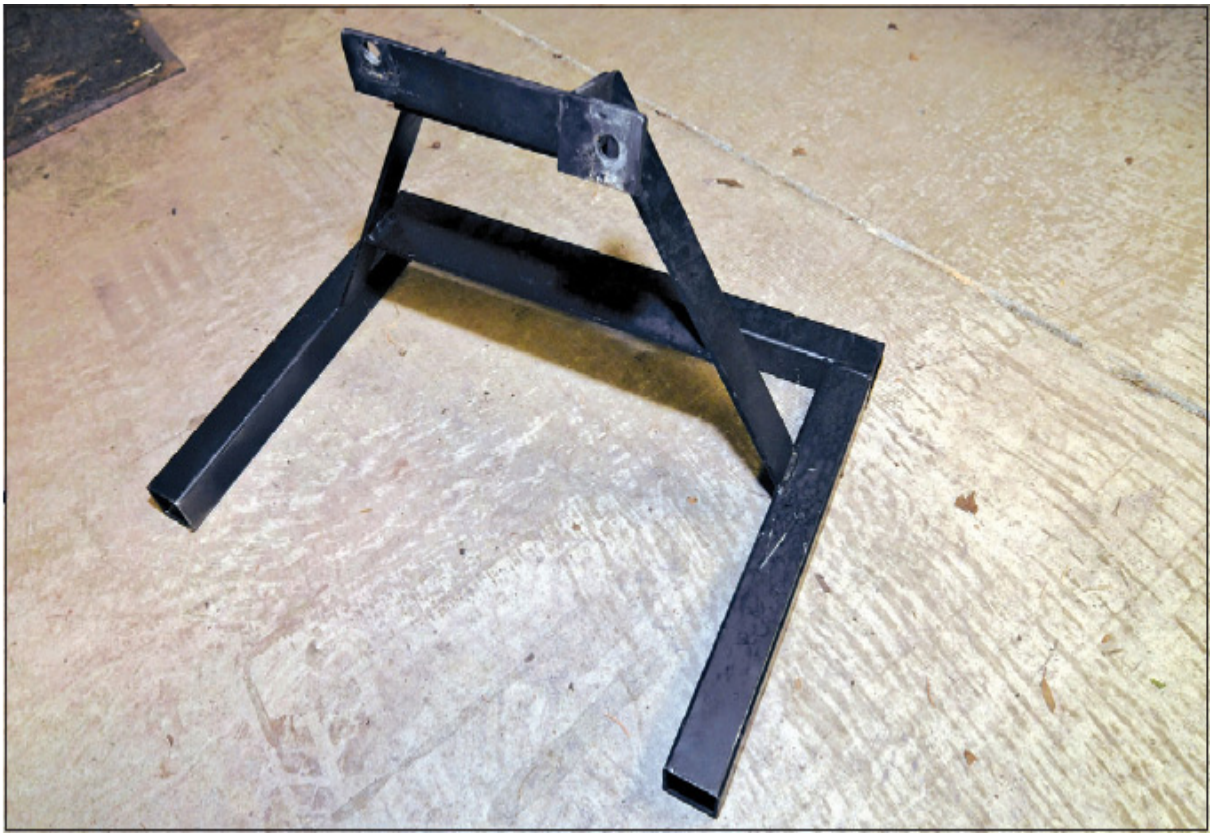
Some scrap bolts, nuts, and washers

Follow these steps:

1 Observe the shape of the item you want to powder coat. Does it obviously have an uncoated side that can be supported from underneath? Or does it have holes into which hooks can be inserted to hang from the broiler rack in the oven?

2 This engine stand has been welded together using box steel. With a bit of creativity, it fit into the oven, but one end had to be propped up to keep it from touching the floor of the oven.

3 The engine stand needed to be off the oven floor by only a couple of inches, so I made a small leg (standoff) using a bolt, nut, and washer. This supported the stand through an existing mounting hole. An additional nut can be used to keep the standoff captive, but at the expense of complete powder coverage on that side.



This engine stand is a great candidate for powder coating, but to fit it into the curing oven without smudging, I have to invent some standoffs and supports.

This standoff fits the engine stand and helps it sit in the curing oven for a good finish. Use your creativity to figure out what you need to fit any given part in your curing oven.

Coat Part in Two Steps

If your part will be completely coated, you can coat it in two steps so that at least one side can be cured without standing on a support.

Here's another part of the solution to get the engine stand suspended in midair inside the curing oven. More often than not, the right solution is just this simple.

With this bolt installed, the stand sits suspended over the heating element while the powder coat cures. Only a small area around the bolt hole might

be smudged.

Stand and Rack Storage

If you wired up a used kitchen oven, chances are good that it has a pan drawer underneath the oven. That makes a great place to store your stands and racks.

4 With the engine stand on the ends of its legs and using the standoff, it fits in the oven nicely. The challenge now is to get it powder coated and back into the oven without smudging.

5 A variation of the standoff was developed when powder coating a Subaru suspension arm. This was a challenge because the piece was L-shaped and all three points had to be suspended to keep the coated surfaces from touching the oven or the rack. One end was suspended using a custom S-hook from the broiler element, while the opposite end was supported using an existing hole in the part.

Here's the finished solution, with the whole engine stand in a typical kitchen oven. It's a close fit, but with these standoffs, I could coat this stand and then put it in the cold oven and turn it on to cure with confidence.

This project was difficult to place in the oven (see Chapter 4 for more details). The bolt standing on the cookie sheet and the two other points on this part are suspended from the top of the oven.

Here, I used a baking rack because the part is not tall, and a cookie sheet provides a floor for the bolt to stand on. The elbow end of the L uses a bolt hanging from another S-hook. Bending a fence clip with pliers made the S-hooks, but a piece of wire hanger would have worked just as well.

6 The part was coated while hanging from a single S-hook. The bolts were then installed through existing holes. By holding the part only by the bolts, I got this part into the oven with only a couple small smudges.

Oven Safety

If you know you will have difficulty getting a part into the oven and properly suspended, do not preheat the oven. You don’t need to add

the risk of burning yourself to the challenge of carefully handling your work. The part cures just fine if it warms up with the oven.

Powder Coating Equipment

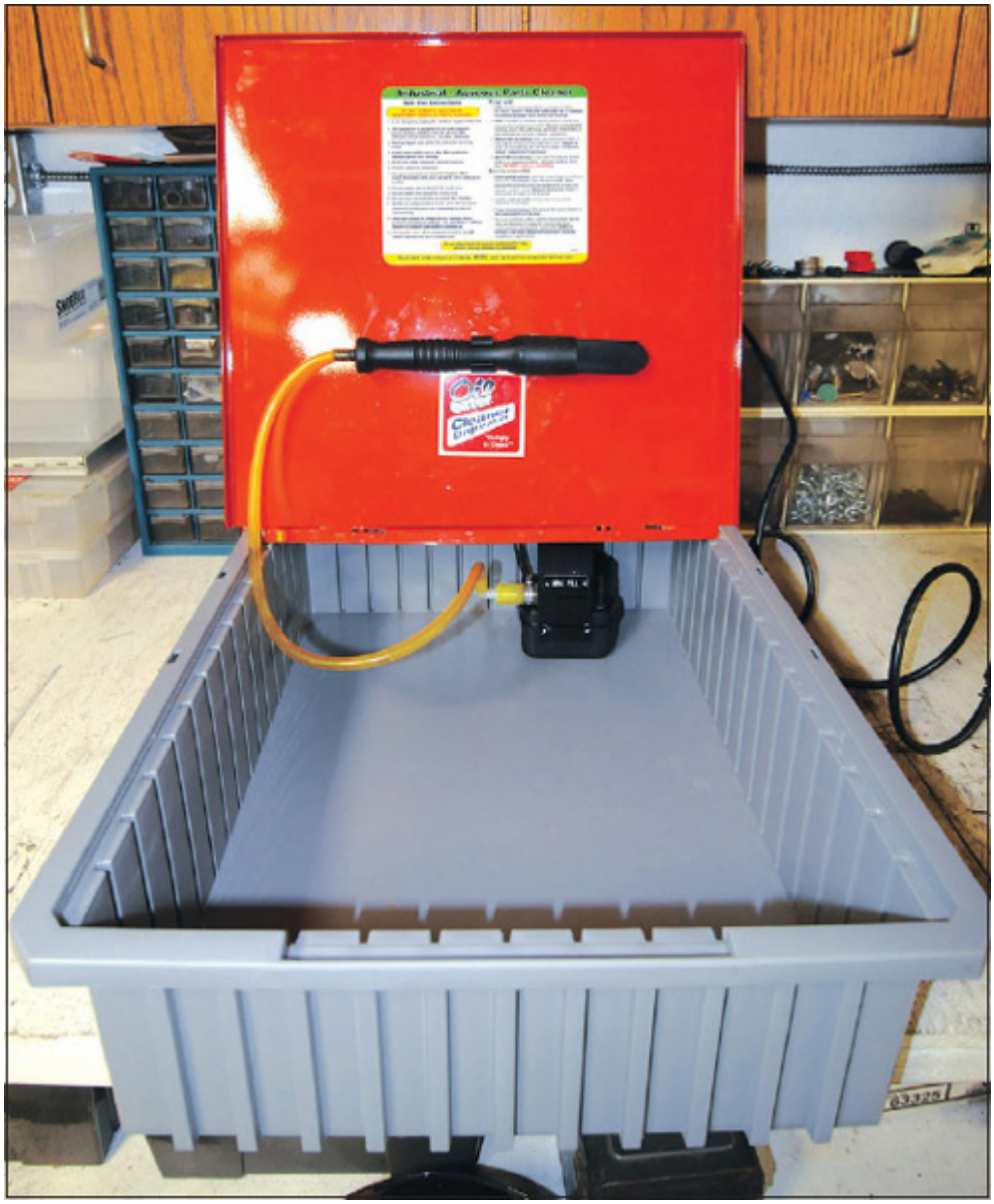
In addition to the powder coating kit, oven, and air compressor, a number of tools can help you get good results from your powder coating efforts. These begin with safety gear and parts cleaning tools, which are important and necessary. In addition, general modification and fabrication tools always come in handy.

Parts Cleaning Tools

You want to obtain at least one automotive parts washer, and probably two. With two washers, one can stay full of water and a detergent-based cleaner while the other remains filled with a solvent-based cleaner such as mineral spirits.

If you want to get serious, a conventional household dishwasher makes a great parts washer, combining heat and detergent. But this requires additional plumbing and environmental considerations.

Another good tool to consider is a benchtop or freestanding abrasive blast cabinet. These take off old paint, baked-on grunge, and rust, leaving a clean surface for the powder coat. Larger blast cabinets have a fitting for a vacuum exhaust system, which is a great addition. When you apply air pressure, the inside of the cabinet becomes positively pressurized and this pushes the glass dust media out through vents, gaps, and everywhere. You will be amazed at how much glass media ends up all over your shop. Put a vacuum on this tool to keep everything clean!



A benchtop parts washer is great for using Oil Eater or other detergent and water combination. It is suitable for all kinds of light cleaning tasks that don't really need the heavy-duty chemical treatment.

You will also want a good supply of wire brushes, Scotch-Brite scrubbers, old toothbrushes, shop rags, and general cleaning supplies.

See Chapters 3, 4, and 5 for more information on parts cleaning for powder coating.

A small media blasting cabinet such as this one is a perfect choice for small parts that have baked-on crust, rust, or paint that resists chemical strippers.

A large blast cabinet can accommodate big parts and offer more power for the blasting operation. Visibility is improved if you put a stick-on light or two inside the cabinet.

Large blast cabinets can accommodate a vacuum exhaust system. This is no more complicated than a shop vacuum attached to the port, and it keeps the shop clean.

For cleaning parts, you frequently have to fall back on the old wire brush to get the last of the gunk and grunge off the parts. Have several on hand so you can use some with your parts washer and keep some dry for lighter work.

Oven Cleaner Safety Tip

Standard kitchen oven-cleaning foam works wonders to remove old grunge from metal parts. However, you must be aware that this material is extremely caustic and you don't want to breathe the fumes or get it on your skin.

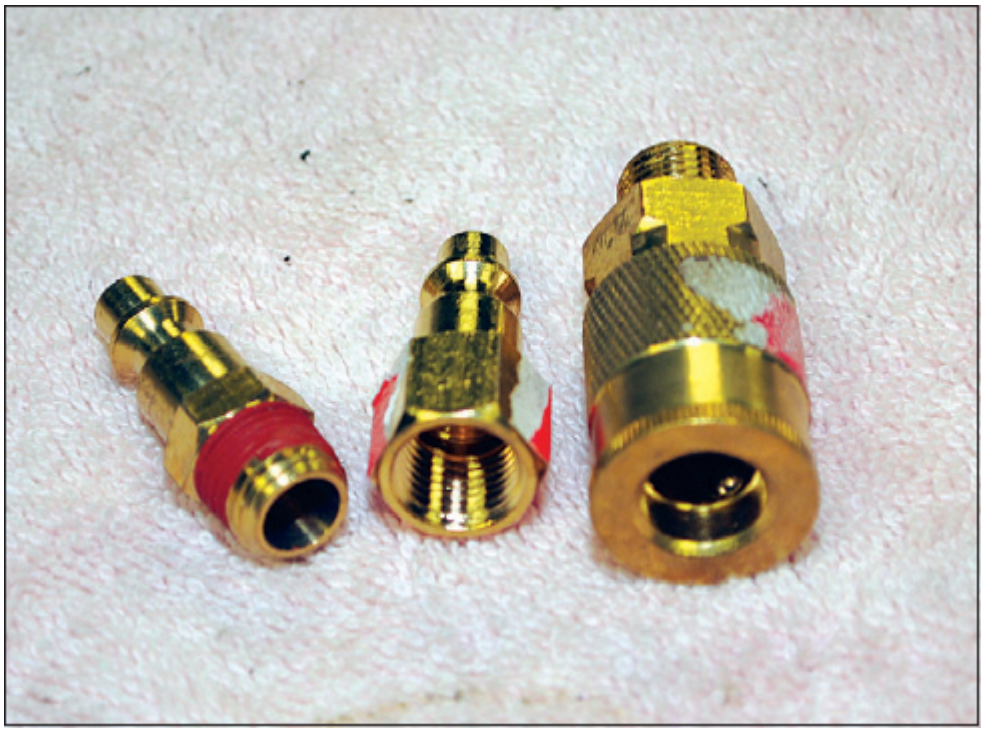
Fabrication Tools

As you work on powder coating projects, you'll soon realize that you need to modify or trim some pieces for the best effect, or to create parts stands and hangers out of metal, wood, or glass. There's nothing like having a well-appointed workshop with some basic fabrication tools for making the exact piece you need.

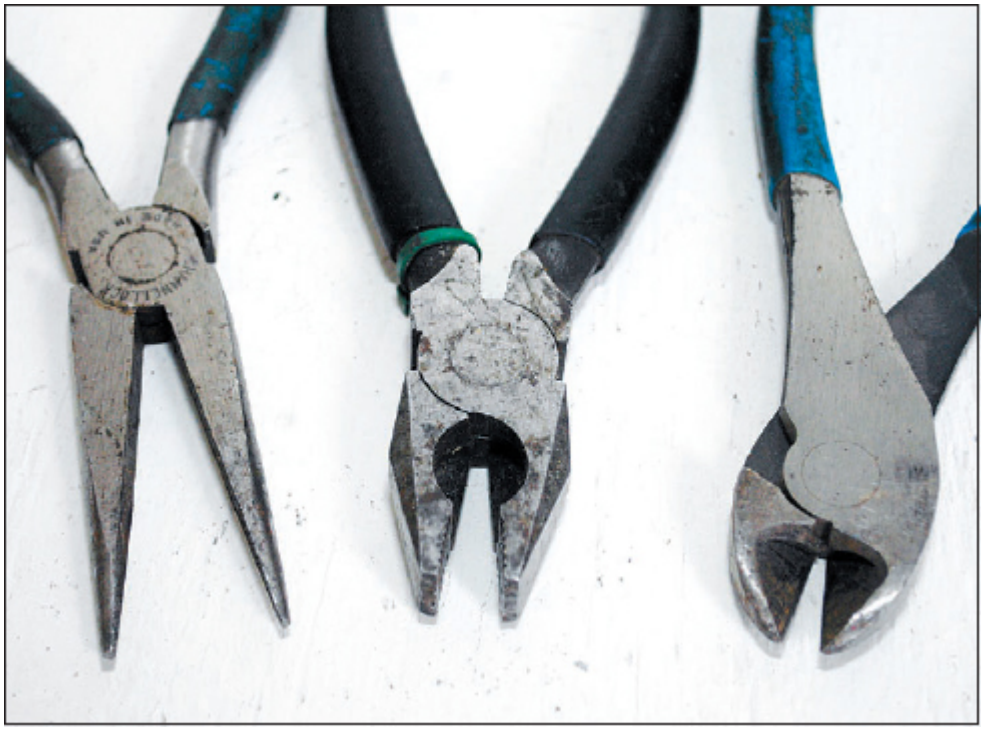
Over time, you're likely to need the following tools:

- Drill press
- Angle grinder with wire cup brush
- Angle grinder with metal grinding disc
- Bench grinder with wire wheels
- 120-volt wire-feed welder
- Bench vise
- Variety of pliers, locking pliers, and cutters
- Blower attachment for your compressor
- Shop vacuum dedicated to the blast cabinet, and another vacuum for cleaning up powder overspray
- At least one fire extinguisher

You can add even more tools, of course. Every workspace is different and has different needs. The good news is that you can build up your inventory over time. Garage and estate sales, thrift stores, and used tool stores can help you get your shop together without breaking the bank.



Pick up a supply of both male and female threaded air fittings in the appropriate style for your shop. Most shops use the standard Industrial style. You will know if yours is different.



A variety of pliers come in handy for powder coating projects. You need (from left to right): needle-nose pliers, lineman's pliers for heavy work, and diagonal cutters. These are basic tools for any shop.

Get a blower attachment for your air hose. This tool is absolutely required for cleaning your powder coat gun and for blowing off powder mistakes.

CHAPTER 3

CHEMICAL PARTS CLEANING

When you set out to create any kind of finish, you learn that your prep work is the most important factor in getting good results. When it comes to powder coating, extreme cleanliness is absolutely critical. It's easy to understand: If there's any oil or dust on the item you're trying to coat, that material is trapped between the powder and the underlying metal, and sooner or later (usually sooner) it separates from the metal and causes the finish to bubble and flake away.

The challenge with cleaning is to get everything absolutely clean without turning your workshop or garage into a toxic waste dump.

Water and detergent-based parts cleaners are generally better to use in home shops than solvents. Water-based products create less hazardous waste, and they can deliver effective cleaning performance. Water-based products also eliminate a big fire hazard in your shop. Some gunk, however, responds better to solvents than detergents.

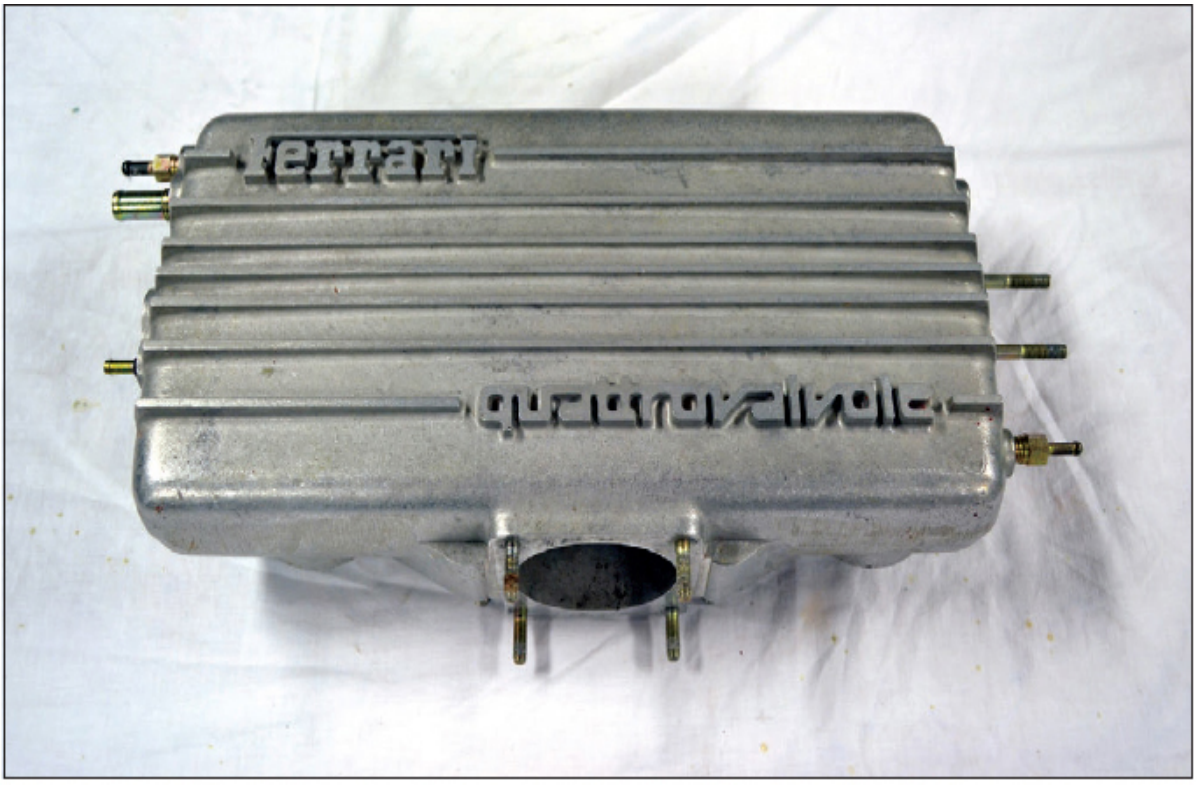
In addition to grime (grease and dirt), you may also need to remove rust and old paint. No one solvent or process is best for all three offenders. If you are using solvents only, consider rotating your parts through different solutions. For example, use a parts dip to remove grease and dirt, then a paint remover, and finally a rust remover. Repeat if necessary. Rinse and dry the parts between solutions so you don't contaminate one solvent with another or cause unwanted or even dangerous chemical reactions. If you are

planning to media blast, cleaning the parts with solvent first speeds up the process.

Mechanical cleaning also has its place, as discussed in Chapter 4. When you have a lot of material to remove, you may want to start with one of those mechanical methods, such as a scraper, wire brush, sandpaper, media blasting with soda, sand, walnut shells, or glass beads. Then you may want to finish with a wet cleaner such as one of the solvents discussed in this chapter.

When it comes to getting good results with your powder coating, clean metal is the most important thing. In this book I spend a lot of time looking at cleaning methods because cleaning really is the majority of the work required to get good results with powder coat.

This intake plenum from a Ferrari 308 was in dire need of refinishing. Subjected to heat and grime, even in a Ferrari engine bay, the original paint is long-since cooked and darkened.



A little work with the Eastwood gel paint stripper and this plenum is ready to be coated. Dental picks came in handy to get the last of the paint out of nooks and crannies in this part.

This part required careful masking, but the prep work was the primary factor in getting great results like this.

Here's what Oil Eater looks like when it's mixed with water and placed in a benchtop parts washer. A pump sends detergent mix through the cleaning brush.

If you have an old parts washer in addition to your new one, you can have different cleaners in your washers for different kinds of cleaning chores. This one has seen a lot of use!

Heavy gloves that are rated for chemicals are good to have around. Nothing eats through them! Often, though, it's a good idea to wear a pair of nitrile gloves under them.

Nitrile gloves are different from latex or other shop/surgical gloves because they are more resistant to more chemicals.

Eastwood makes a wipe-down cleaner called PRE Painting Prep. This is a great final wipe-down product to be sure that no oils (even skin oil) or

dust is left on your parts before you coat them.

POR-15 also makes a final wipe-down cleaner that can be used to ensure that oil and dirt have no place in your powder coating operation.

Material Safety Data Sheet

If you are not sure if a particular product is safe to use, or how to protect yourself from it, consult the Material Safety Data Sheet (MSDS). This is a standard informational sheet that every industrial/commercial product manufacturer must provide. The MSDS lists the chemical composition of a product and its health and environmental hazards. Most of the MSDS for commercially available products are available online.

If you have plumbing in your shop, consider installing a used sink. You can usually find them for free or for a very small price on craigslist or at a ReStore. Just be careful not to flush hazardous chemicals into the sewer system.

Chemical methods of cleaning metal vary widely, and the best ones to use vary based on the type of metal you're cleaning and the type of gunk you're cleaning off the metal.

Remember that any chemical intended to clean metal can be very toxic, and can "burn" your skin. Be sure to have several sets of chemical-resistant gloves near each parts washer. You don't want this stuff on your skin. Always read the labels and follow the safety precautions that manufacturers recommend; add a good helping of your own common sense, too.

Cleaning Agents and Solutions

You can start with a bucket and soapy water, or a large can of solvent such as B12 Chemtool or mineral spirits. For a bit more money, you can buy a benchtop or freestanding parts washer that uses either water or solvent-based fluids. Many restorers use gasoline, biodiesel, or kerosene instead of the more expensive solvents in those cleaners.

If you plan to clean a lot of parts, and you have a sewer connection in your garage or shop, you can usually obtain a working dishwasher at very low cost and install it in your shop. Take out the top rack and you can fit some very large pieces into it and wash them with detergent and steaming hot water. This works very well.

A common dishwasher sourced from craigslist or ReStore makes a great home parts washer. The same rule applies: Be careful not to let hazardous chemicals drain into the sewer system.

Each of these options has some trade-offs, and that's why many shops have more than one type of cleaning station. Many solvents dissolve or substantially weaken rubber parts, including the diaphragms in mechanical fuel pumps. Room-temperature water-based cleansers are less effective on grease and oil-based gunk, even with soap or detergent additives. Water can also pose a rust problem on some surfaces.

In general, you can do a good job with a small benchtop solvent-based parts washer and a bucket with some Simple Green or Oil Eater detergent and hot tap water. If you think you might need more, you can get a couple different benchtop units and fill them with different materials. Be sure to label each one!

If you build a simple cabinet around the dishwasher, you can use it as part of your workbench or for storage when you're not washing parts. Plus, it adds stability to your parts washer.

Scrubbing Brushes

Buy a set of scrubbing brushes for each of your parts washers, and don't trade those brushes back and forth! You want a variety of steel wire brushes, a brass wire brush, and some nylon brushes. These are cheap, so get several of each.

Water and Detergent

The safest cleaners you can use are detergent and water. Water alone doesn't strip dirt or many other impurities on the surface of a project, but detergents are effective because they dissolve oils and greases and hold dirt in suspension while you wash. Note that soaps can also be used, but they often leave behind more residue than detergents.

Hot or warm water works better than cold water simply because so much of the gunk that needs to be removed from automotive parts is grease based. The more you can melt the grease and oily stuff, the easier it comes off. Pressurized water is also an effective way to get rid of buildup and even paint. So it stands to reason that hot, pressurized water with some detergent in it is the most effective way to use detergent-based cleaners. If you have a hose bib that delivers hot water, connect it to the pressure washer rather than connecting to it a cold-water source.

Dishwashing Soap

Many professional shops and restorers use Dawn liquid dish soap. Dawn attacks grease very effectively but is mild on everything else. You can put it right in your parts washer just like doing the kitchen dishes. Cascade-brand dishwasher detergent uses the same ingredients as Dawn.

A small water heater can heat enough water to fill your bucket without running up the electrical power bill in your workshop. Some models fit under a standard counter.

You can generally rent a pressure washer with a kerosene-fired preheater for the water and a siphon to pull in some detergent, but these are mainly used for big jobs such as cleaning the underside of a car or an entire engine. Still, if you have enough material to clean, it may be worth the rental fee from time to time.

Oven Cleaner

One of the more effective cleaners you can pick up in any grocery store is ordinary oven-cleaning foam. You simply spray it on and let it work, then wash it off with water. This is particularly good at dissolving gunk that has been baked onto your parts. But be aware that just because oven cleaner is readily available, it isn't less nasty, and you really don't want it on your skin.

A larger apartment-size water heater will provide enough hot water for any use you might have in a larger workshop. You can install it on a shelf to keep it out of the way.

Citrus-Based Cleaners

A variety of cleaners are based on citrus oils. You can purchase a spray-on cleanser similar to brake cleaner (TCE, TriChloroEthylene) but nontoxic. Some paint strippers are based on the same materials. These are indeed less toxic than the more chemically active products, but as you might expect, they do not work as quickly or completely. For lightweight jobs, these products are perfectly acceptable and kinder to your body and the environment.

Kerosene, Diesel, Biodiesel

Kerosene and Diesel fuel are oil-based, and they do a good job of dissolving oily crud. They are popular choices for benchtop and freestanding parts washers, and they're safe to use inside your shop with reasonable fire precautions. Biodiesel is even better because the oils in it dissolve the grease better than the petrochemicals do. As with many other cleaners, keep heat, flame, and spark sources away from these flammable liquids.

Gasoline

I do not recommend using gasoline as a cleaning agent because it's volatile and potentially dangerous. Although it effectively dissolves oily and greasy gunk, it's also highly flammable and full of other chemicals, such as benzene and ethanol. Gasoline fumes are poisonous and easily ignite from any spark. If you do choose to use gas, never use it in an enclosed area.

Also remember that unsealed gasoline evaporates away, leaving behind a kind of varnish that you don't want on your parts. Other products are far safer and work just as well.

Mineral Spirits

Mineral spirits, generally known as paint thinner, do a great job of cleaning oily residues. There is a difference between the two though. Paint thinner is less pure, and often includes other petrochemical ingredients. Mineral spirits are far more expensive, but also far more pure. Both of them are related to turpentine, but that's a vegetable oil–based product.

Plain old paint thinner works well for getting rid of many paints and coatings. Be sure to leave it in the can and use it in a well-ventilated environment, as it quickly evaporates into fumes.

In general, mineral spirits are a much safer choice than gasoline for the same effect, and being purer it leaves less residue behind. Be aware that in an unsealed container such as a parts washer, mineral spirits evaporate in a few weeks, leaving an ineffective varnish-like liquid behind.

Acetone

This solvent, like gasoline, is best left out of a large-scale cleaning process. Acetone is volatile, ignites easily, and produces a lot of vapor. Generally speaking, a small can of acetone can be best used for spot cleaning of resistant coatings such as polyester or epoxy-based paints, tape residues, and glues, including cyanoacrylate, commonly known as Krazy Glue or Super Glue.

Chemical Paint Stripper

Chemical paint strippers (as distinct from a citrus-oil version) are typically based on caustic soda (sodium hydroxide) or methylene chloride. Both of these are extremely nasty materials, so you should be sure to work in an open area and use your best gloves. However, they quickly strip old paint and varnish from parts.

Solvent Dangers

Different solvent-based solutions have varying effects on the pumps used in parts washers and can even melt the body of plastic benchtop washers. Be sure you understand the pros and cons of the solvents you're using before you ruin your tools. In general, avoid acetone and use only solvents that are safe for rubber and plastics.

It's worthwhile to have a can of Jasco (which is based on methylene chloride) in your arsenal, especially for cleaning parts previously painted with two-part epoxy paints. Don't leave any methylene chloride on steel or cast-iron parts for very long, as it attacks those materials.

Furniture-grade paint stripper is pretty nasty stuff. Use this kind of product sparingly, but keep it in your arsenal. Citrus-based versions are less toxic, but they don't work as effectively, especially on old and hardened finishes.

Methylene chloride is safe to use on aluminum parts. Do not use caustic soda because it attacks the aluminum.

Brake Cleaner

Trichloroethane (TCE) and perchloroethane are used in brake cleaner sprays. These solvents are very effective at dissolving all kinds of grunge, but they're expensive to buy in small cans. You don't want to have prolonged exposure to these chemicals on your bare skin, or in an unventilated working area. It's best to avoid them for major cleaning jobs, but good for removing oily residue in spots.

Rust Removal

Chemical rust removers are nothing short of amazing in their ability to clean even deeply rusted parts. The several options include acid-based naval jelly, acid-based etching solution, and urea hydrochloride–based rust dissolver. Of these, the urea hydrochloride, such as Eastwood Rust Dissolver, is the gentlest to use in your home shop.

These products may be painted on as a gel or used in liquid form as a dip. These products work by reacting with the iron oxide (rust), and they eat into the metal a little bit. They continue working as long as they are in liquid form on the metal.

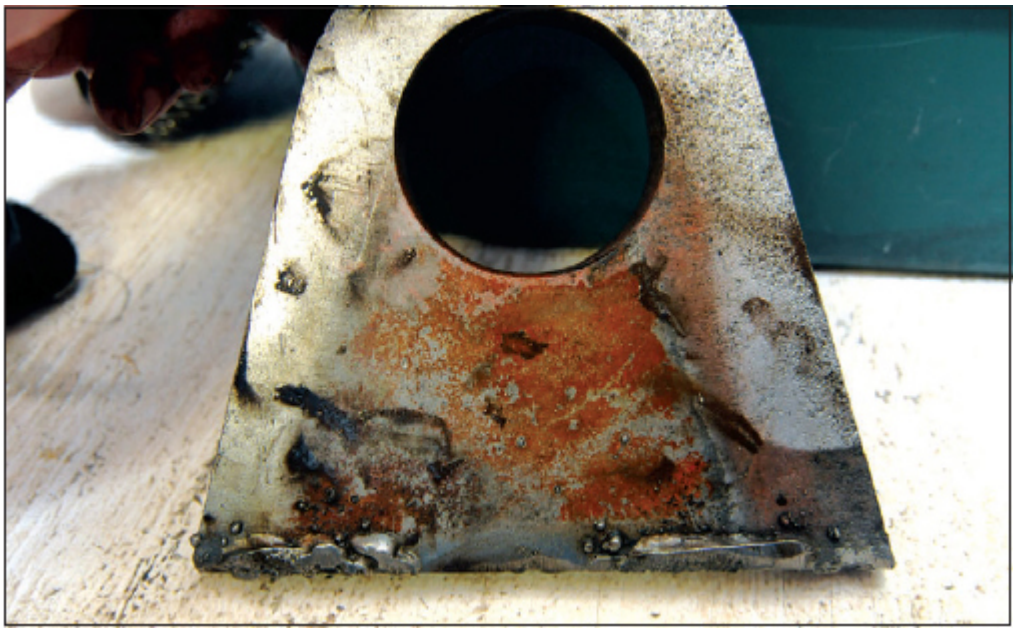
All of these products can be cleaned up and deactivated with plain water. You still need to wear neoprene or nitrile gloves and eye protection when you’re using them. Also use them in a well-ventilated area, because they produce fumes. Combining rust remover with scrubbing works very well.

Eastwood Fast Etch contains an acid that attacks the iron oxide that makes up rust. A bit of scrubbing with this product goes a long way in getting rid of rust, and you can neutralize it with plain water in your bucket.

Eastwood Rust Dissolver is made of urea hydrochloride, and it eats rust very quickly. Give it a little more time and it attacks the rest of your iron part and eats it away into nothing. You can neutralize this product with water; you want to do that as soon as the rust is off your parts.

Here's a rusty part I picked up at the recycling center. I will treat it with Eastwood Rust Dissolver, and then give it a wire brushing to really make it shine.

I soaked the part in Rust Dissolver, brushing the fluid onto the parts not actually soaking in the pan. You can see that the rust is washing off quickly. I left the solution in the pan after this project, and in about a week it ate through the pan and leaked onto the workbench!



Most of the rust is now gone. The orange stain is not rust, but a residue of the cleaner. It just needs a little quick work with the wire wheel on the bench grinder to polish it.

Here's the part, ready to coat. When your parts are clean, you should powder coat or clear coat them as soon as possible because the steel is completely unprotected and will start to rust again immediately.

Rust Removers

Rust removers are acid-based, which means they eat into metal. Paradoxically, iron-based metals rust much worse once they have been exposed to acidic rust removers. Do not leave a part soaking in this substance long-term if you want to keep the part. Similarly, do not leave a metal pan full of rust remover on your workbench, or you'll come back a couple weeks later to find it has eaten through the pan and leaked all over your workbench. Yes, this happened.

Phosphate Coatings

As part of your preparation for powder coating, consider creating a phosphate layer on your metal. Phosphating is a process whereby an acid-etch treatment leaves behind a layer of phosphate mixed with the underlying metal. The acid and other ingredients in the phosphate solution create a chemical reaction with the surface of the metal that leaves a layer of iron phosphate crystals on the surface of the treated piece.

The phosphate protects the project from rust and enhances the bonding of the powder coat and the underlying part so it makes a great surface for powder coating. The result is a coating that is better looking and more durable, so your powder coat project looks better and lasts longer.

The easiest way to create a phosphate layer is to use one of the many products on the market. These are all based on either tannic acid or 2-butoxyethanol and may also include phosphoric acid. You can use dedicated phosphating solutions. You can create a phosphate layer on bare steel by spraying any weak phosphoric acid solution over it.

It's best to use these products just before powder coating. You want to coat immediately after the layer is formed. If possible, do not even touch the part before coating.

Metal Treatments

Commercial metal cleaners often include an iron or zinc phosphate treatment as part of their services.

If you're working with aluminum, a similar process is known as chromating. Either way, it's best to consider this an immediate precoating treatment. Don't leave phosphate sitting open to the air for long periods of time.

Commercial Chemical Dipping

Chemical dipping is primarily the use of a big tank of the same sodium hydroxide solution in some paint strippers. Although you can purchase a small amount and do your own dipping, this process is generally the

province of professionals. If you're thinking of coating a whole set of wheels or other large parts (or a large number of small parts), professional cleaning may be the easiest and most cost-effective option.

Dipping effectively gets rid of paint, body filler, and almost anything that isn't steel. It does not dissolve lead, so if your part has some lead filler, you can use it. But the caustic soda completely dissolves aluminum, so don't try it with anything that has aluminum content, such as pot-metal carburetors or other parts. Similarly, dipping agents, such as methylene chloride, are safe for aluminum but eat iron-based parts, so make sure you are using the correct chemical for the job at hand.

This is an example of a part that should probably be taken to a professional metal stripping and cleaning business. It's not that you can't get rid of the grunge, rust, and paint by yourself, but it would be a lot of work, use a lot of product, and it's heavy. It will cost less, be easier, and you get better results with the pros.

Project: Removing Multiple Paint Layers

A good time to consider commercial professional metal stripping is when you are removing factory paints or multiple layers. One cleaning

project I undertook was a valve cover from an MG sports car that had several layers of paint on it. At least one layer was epoxy-based and did not respond to any chemical paint stripper. A flapper sanding wheel was not strong enough to cut the hard paint layer, so a wire wheel cup brush on an angle grinder was required to complete the job.

Once parts come out of a caustic soda bath, which has a chemical base, immersion in a muriatic acid bath neutralizes them. That's the same acid added to the water in swimming pools. As a plus, the acid removes rust that a caustic bath can't touch. Generally, the chemical stripping process includes steam cleaning and washing out of all chemicals used in the process. Be sure to ask about that when selecting a cleaner.

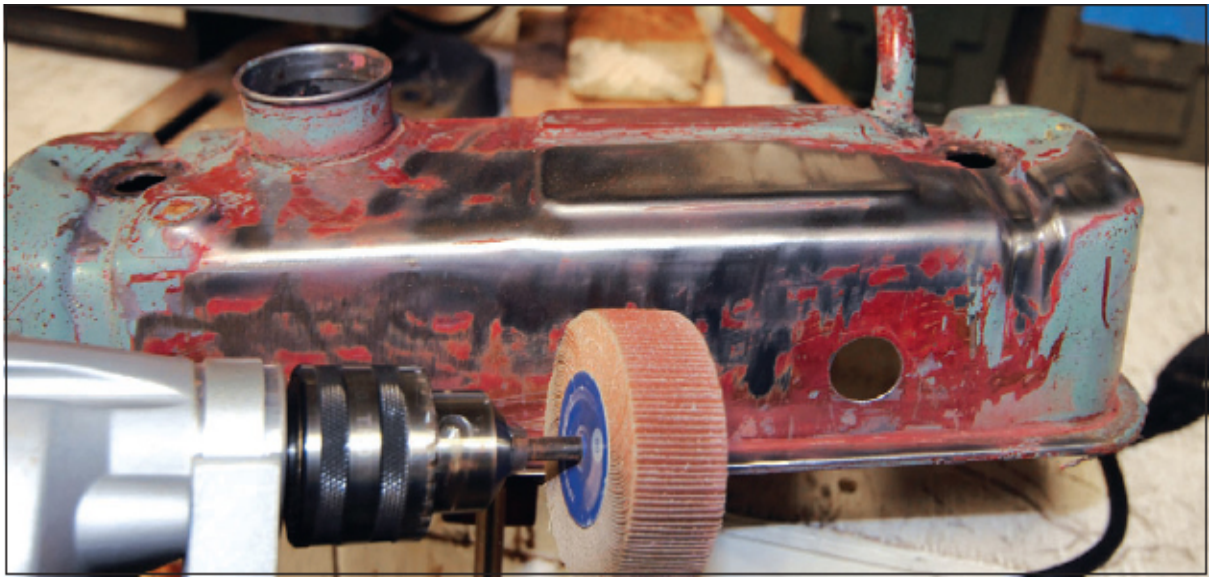
1 ***This MG valve cover had multiple coats of paint and lots of old glue and grunge on it. I wanted to see what it would take to really clean it.***

2 ***Step one was paint stripper. I brushed on Eastwood gel stripper and it took the top layer of pink paint off in a thick, sticky paste.***

3 ***I had to scrape off the pink goo. Whatever it was, it started setting up with the paint stripper gel and solidifying again! It could not be easily wiped away.***

4 ***Once I got the pink goo off, I found a coat of light green paint. This was loosened with another coat of fresh gel paint stripper and scraped off.***

5 ***Beneath the green was a coating of the original crimson color from the factory. This did not respond to the gel paint stripper at all, so I resorted to power tools to get down to the metal.***



6 ***The sanding wheel did not get the job done on the flats, although it worked okay on the corners. I would have to get out the big guns.***

7 ***A wire wheel cup brush spins at high speed and takes off anything that can possibly be removed. Be careful not to remove any more metal than necessary. Use this tool carefully on anything other than steel.***

8 ***Here's the valve cover with some clean metal finally showing! I still have a lot of work to do before this part is ready for powder coating.***

Soda Dipping

It is important not to use any caustic soda dipping process on chrome or other plated materials. Cadmium-plated fasteners are common in automotive applications, and this process removes all the cadmium coating.

Metal's Good and Body Filler's Bad

Any kind of nonmetal filler on metal parts is worse than oil and dust on your powder coating surface. Whether it's body putty or filler (including Bondo and other trade names), it has different characteristics than the underlying metal. It does not conduct electricity so the powder does not adhere to it in the same way as the surrounding metal. Also, fillers can't take the heat of the curing oven. They expand at a different rate than the surrounding metal and crack or mar the powder coat.

In the end, you just can't powder coat Bondo, JB Weld, or any kind of filler effectively and expect to get the same long-lasting toughness and quality finish you get on clean metal.

You need to take care of defects in the metal with metal. That means patching or welding up holes, welding up cracks, grinding, and then sanding the surface smooth again before you apply powder. To make this process a little easier, Eastwood has low-temperature soldering/brazing metal. Don't use this in a stressed part; such products won't fix a crack in your car's suspension! But they work admirably to fill rust pitting or small indentations left over from modifying a part.

Whatever you need to repair, get your metalwork absolutely perfect before you coat. The best news is that a good layer of powder coat hides scuffmarks, so it doesn't have to be the prettiest fix in the world, just smooth. ■

Project: Powder Coating a Dirty, Unprepped Part

I, as well as many others, have stressed the importance of cleaning your parts, and this book is no exception to that chorus of unanimity. However, what most resources never show you is exactly *why* you need to clean every part thoroughly and what happens if you don't. So, to settle the matter once

and for all, I decided to powder coat an old, used part with no preparation at all.

I picked a coil spring from a rally car as a test subject. The spring was covered in the remains of old powder coating, rust, and a little dust.

Project Details
Cost About $2 worth of powder
Time to build **About an hour** **Tools** **Powder coating kit** Wire to hang the part in the oven
Curing oven
Supplies Dirty, rusty part
Powder

Follow these steps:

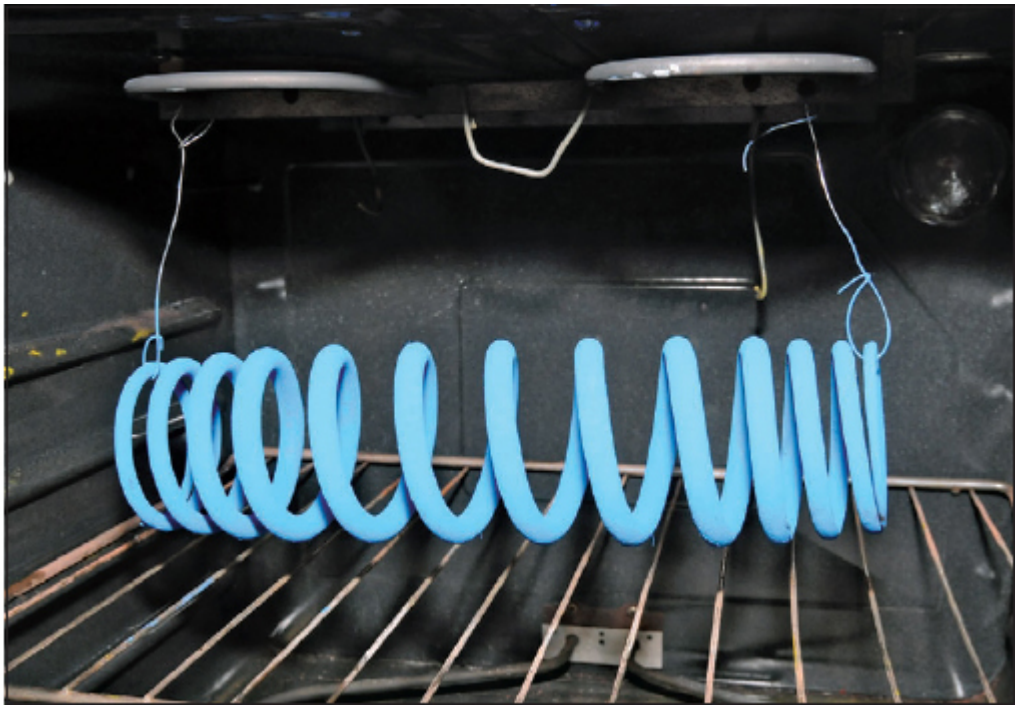
1 Hang the old part with wire to facilitate an even coating.

2 Connect your powder coating gun and follow all regular coating procedures. Spray a good, thick coating of powder on the part.

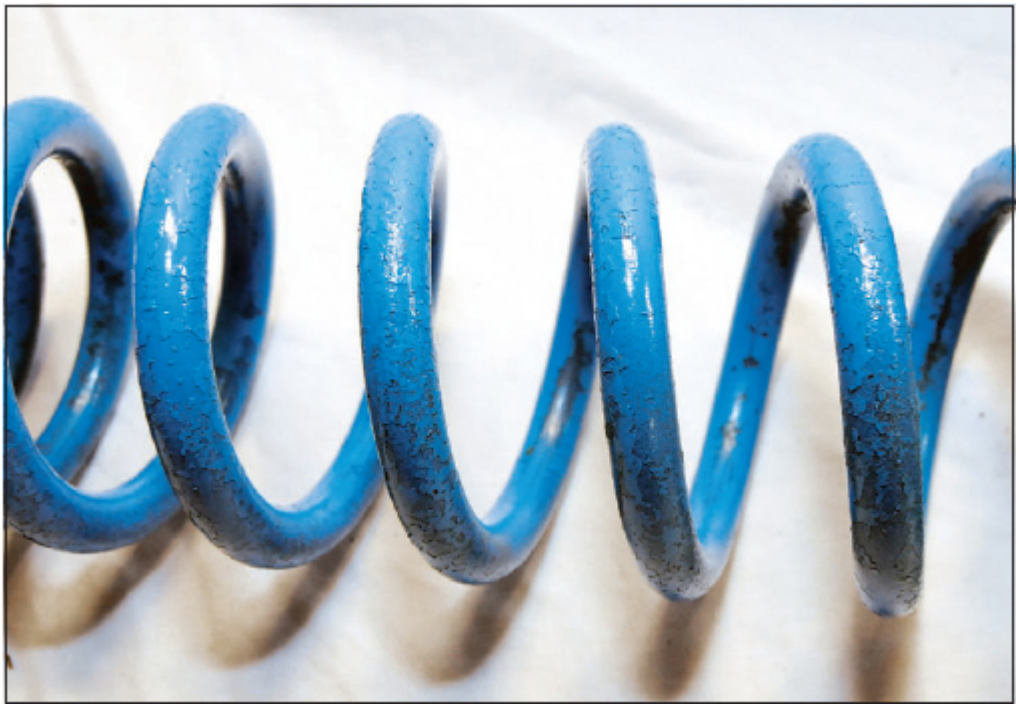
3 Transfer the part to the oven and bake it, paying attention to proper curing time and temperature. When the part has cooled, take it out and inspect the results.

Here's a sample cleaning project with an object lesson. I decided to coat this spring without cleaning it to see what would happen.

I hung the spring using some safety wire so I could get all the way around the part for good powder coverage. I wanted to give this dirty spring every chance to get a good coat of powder.



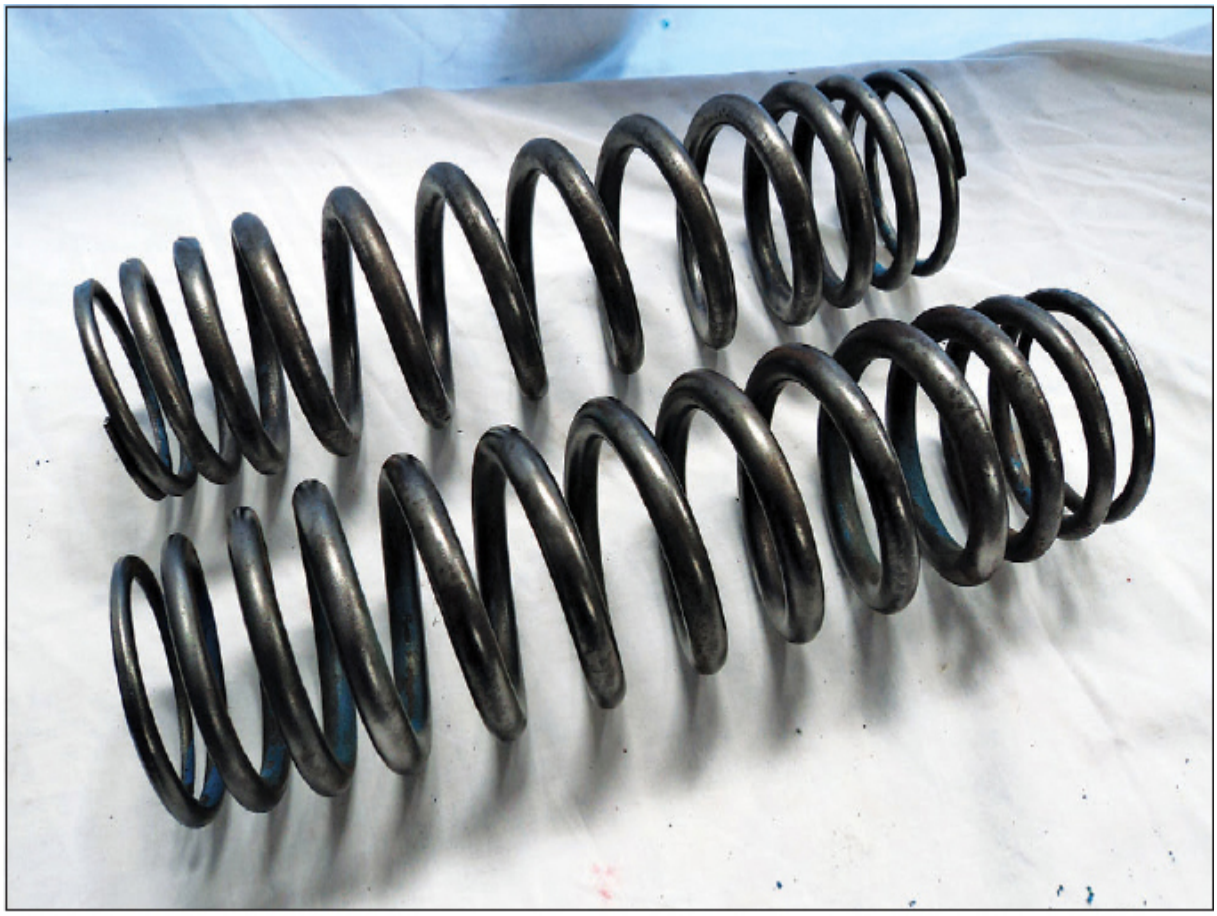
You can see that I put plenty of powder on the dirty spring with the hope that it would cover up the rust, old paint, and grunge. Then I hung it in the curing oven and baked it until it was fully cured.



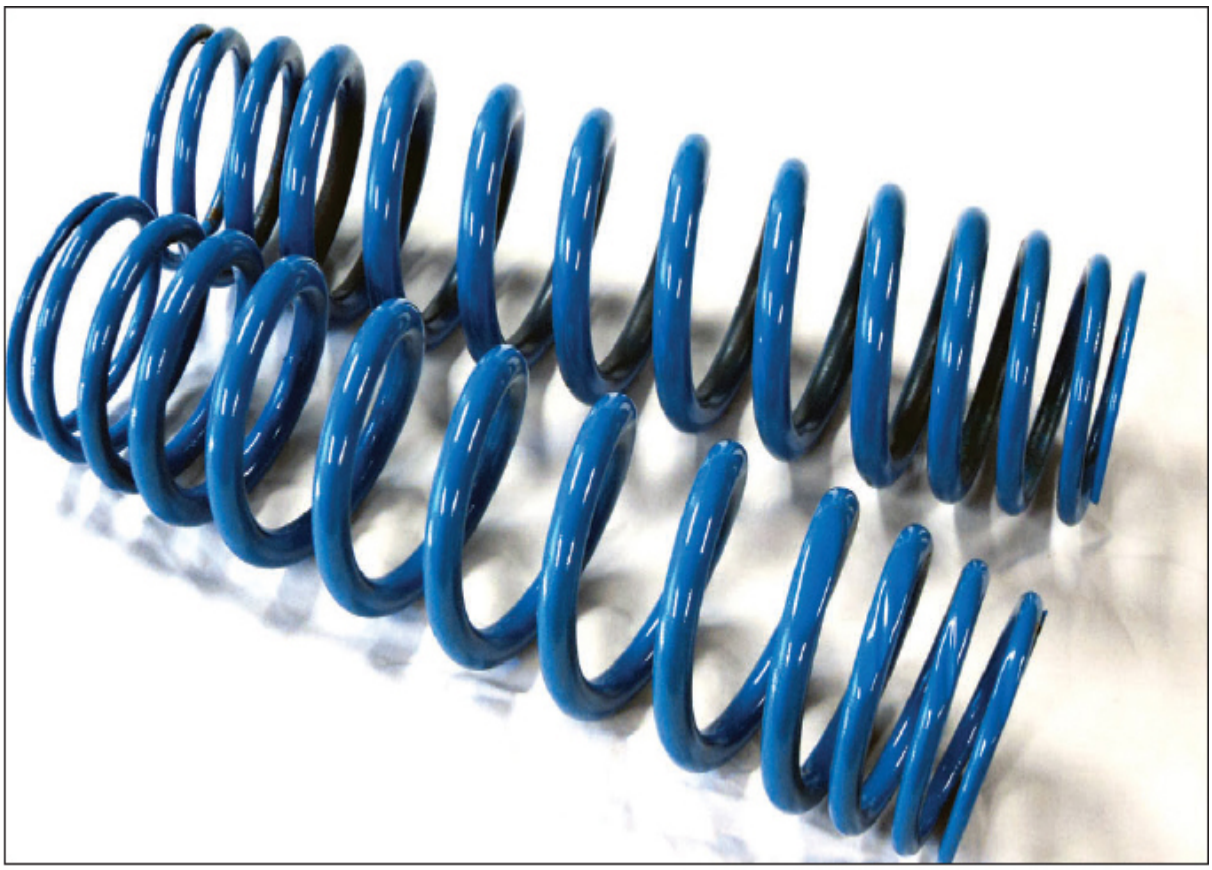
Here are the terrible results of the experiment. The new powder has not covered any flaws at all. Even the new powder coat will be flaking off in a few days. The experiment was an unqualified disaster.

I put the spring into a foil tray and started with Eastwood gel stripper to get the powder coat off. It took two coatings and a lot of wire brush scrubbing to get everything off.

With the second treatment, you can see some metal underneath. I wanted the spring to be perfectly clean this time around.



Here's the cleaned spring (top), with its mate (bottom). Every bit of old powder, paint, and grunge has been removed. I wiped them down with PRE Painting Prep before I coated them for a second time.



And here's the result when I did the job properly. I put about the same amount of powder on the springs the second time, and the results are spectacular. The lesson is simple and easy: Don't skimp on your cleaning and prep!

Although powder coating flows into some scratches and low places to hide a few scars, a finished powder coating is not nearly deep enough to cover the highs and lows of active rust and old, flaky powder coat. The results look terrible, and although powder coating is tough and wants to stick to the part, if the powder sticks to rust, dust, or other paints that are already flaking, it's going to come off sooner rather than later.

After the bad results were photographed, I went back and did the job right. I spent about two hours using gel paint stripper to remove all of the

powder coat, and then I spent some time with a bench grinder and wire wheel to take off the rust and remaining coatings. I recoated and cured again, and with proper preparation I achieved a smooth, even coat that is suitable for use on a show car.

When powder coating suspension springs, you need to closely monitor the curing temperature. You must not apply excessive heat during the curing process. If you apply too much heat, the springs lose their temper and the spring strength can be reduced. Curing temperature must remain below 350 degrees F.

This project may be stating the obvious, but it was worth it to see exactly what happens when cleaning is neglected. The point is this: Do not fool yourself into thinking that you can get the same results without cleaning your parts. Powder coating is easy to do successfully, but good results depend on good prep work.

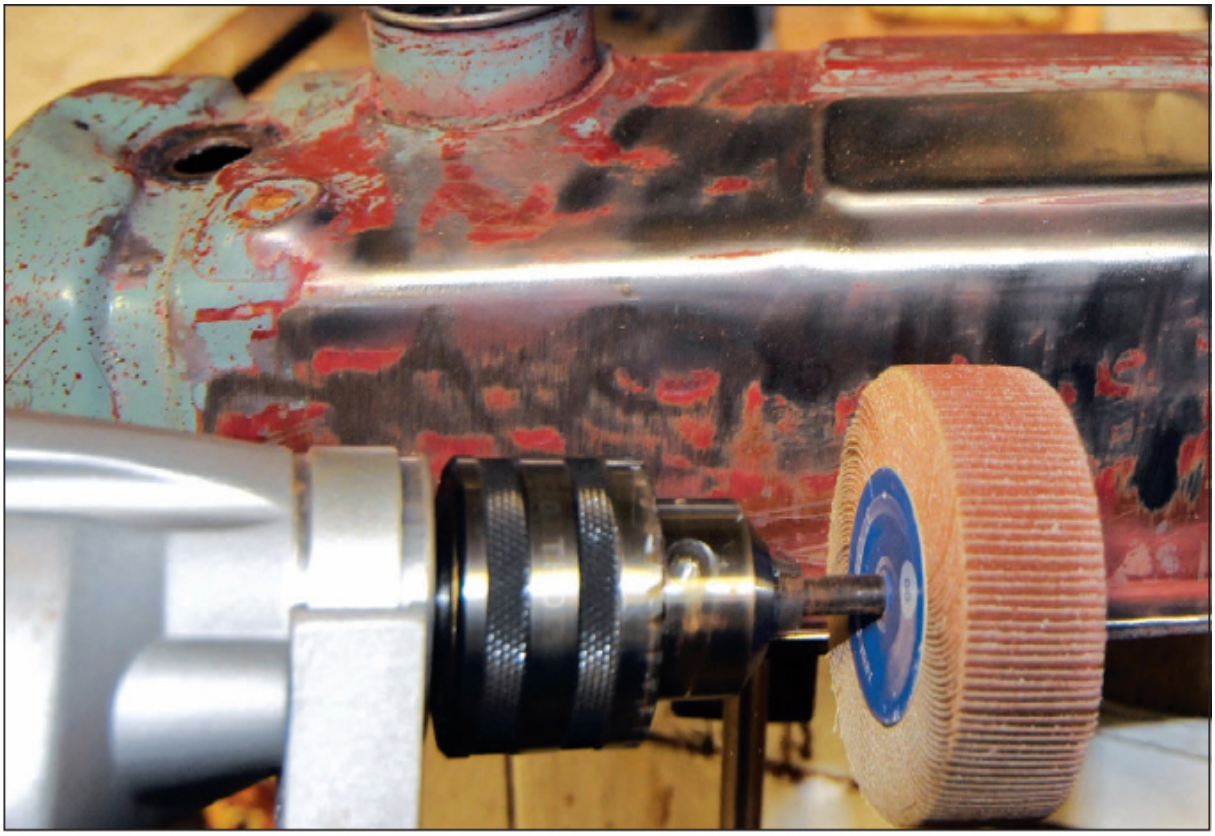
CHAPTER 4

MECHANICAL PARTS CLEANING

This type of parts cleaning includes both manual and motorized cleaning methods; no chemicals are involved. In addition to wire and nylon brushes, you want to have a couple of scrapers on hand to remove caked grime. A good putty knife works well for surfaces where scratches don't matter. Otherwise consider a plastic spatula.

Another great cleaning tool is a big pack of common kitchen Scotch-Brite or similar pads. You can use them and throw them away when they get dirty. They also make good filter elements if your benchtop parts washer has a fluid pump. You can use kitchen scouring powder with the pads for very good results.

For long bolts, you should have a bench grinder outfitted with a fine-steel wire wheel or a soft-bristle wheel to remove rust and accumulated gunk. For a complete job, a buffing wheel is a nice addition. You can use some jeweler's rouge to polish many parts to a high shine.



If chemical cleaners don't get the grunge off your parts, you have to scrape it off using whatever tool works. Sanding wheels, wire brushes, and scrapers are all part of your arsenal.

For delicate or intricate work, you may want to spend some time with a set of dental picks, working the grease or crud out of brand-name stampings or other indentations. The same technique is often used on the nooks and crannies of brackets and castings.

With any abrasive blasting, dust is an issue. There's always a little bit of material left in gaps, spaces, and box sections. Do your best to clean that out with a shop vacuum, compressed air blower, and the time-honored method of turning the part over and shaking it. But don't be surprised if you don't get it all.

Brushes

A basic handheld wire brush is an important tool in your cleaning arsenal. Be sure to have a selection of them with plastic, brass, or steel

bristles. Use these brushes in combination with a solvent or detergent parts washer to really get in and scrub your parts. The job takes longer with a handheld brush, but you can work in a careful and precise manner.

Here's another tip: Keep your old used toothbrushes in your shop for super-fine detail cleaning work.

Using Dry Ice to Clean Parts

Sometimes you can remove difficult substances such as spray-on undercoating, fibrous tar soundproofing, or other thick, sticky coatings from metal by using dry ice. It is available at many grocery stores and most welding shops.

Dry ice is carbon dioxide that has been frozen into a solid block at a temperature of –109.3 degrees F. You need insulated gloves to handle it; even those get too cold to work with the substance for long periods. Don't put dry ice in contact with your skin if you can help it. You'll get a "burn," which is actually frostbite.

Wear eye protection and use the dry ice in a well-ventilated place. Dry ice isn't toxic, but as it evaporates it turns into carbon dioxide gas, which can create a low-oxygen environment if not allowed to dissipate.

The cleaning process is easy: Simply press the dry ice against the part to be cleaned for a few seconds and then strike it lightly with a hammer, or use a chisel to chip away the gunk. The dry ice freezes the metal and creates a temperature differential between the coating and the underlying material, helping release the gunk. Be careful: Because they are frozen, even flexible materials tend to shatter when struck. ■

Basic scrubbing brushes are handy. Get a variety of brushes with bristles of brass, plastic, and steel wire.

For fine work, recycle your old toothbrushes. They come in very handy and if they get mucky you can just throw them away.

Any hardware or tool store should have a wide selection of wire wheels for your bench grinder. Many shops use two or more bench grinders with wire wheels of varying stiffness (different wire grades) for different purposes.

Wire Wheels

Wire wheels come in all sizes and grades of wire. Some have straight bristles, while others have twisted or knotted wire for extra toughness. You can attach a wire wheel to a power drill for a low-speed and gentle tool, or put one on a bench grinder or auto body grinder for more intensive work.

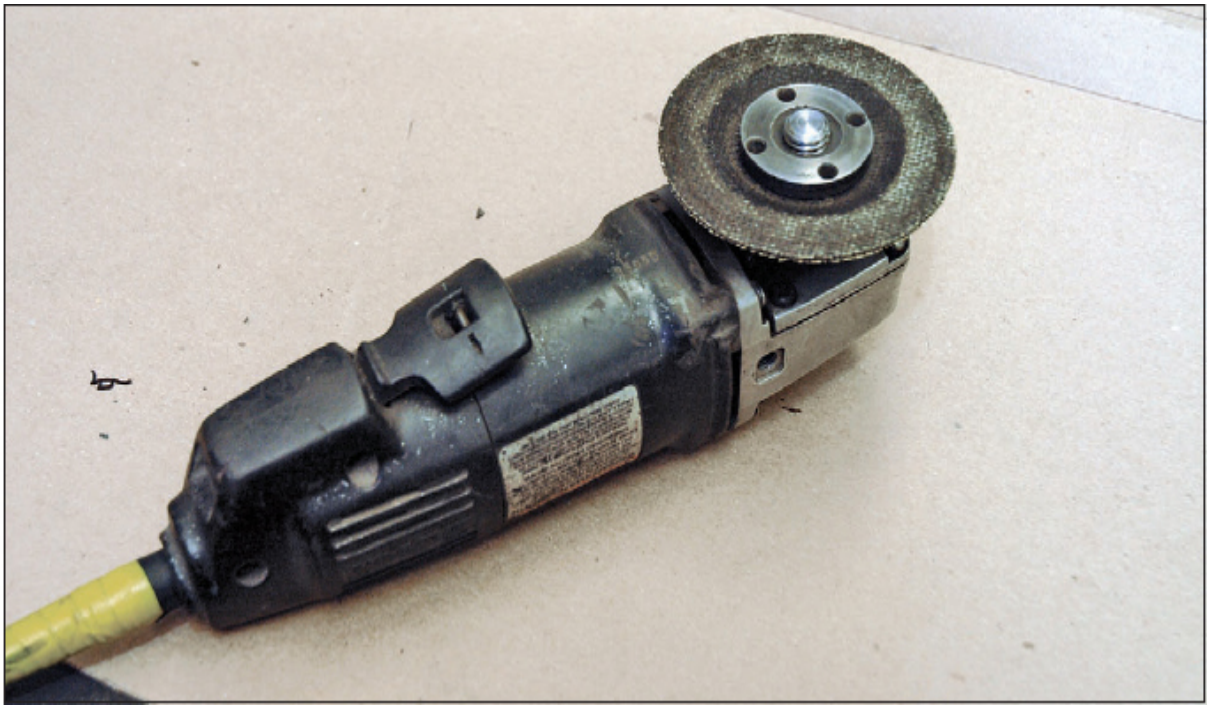
Always be aware of the danger of a wire wheel. They throw off wires constantly, and your eyes are always in the line of fire. Keep a pair of safety glasses next to every wire wheel. And use them!

Grinders

Sometimes, to clean a part you need a grinder. Depending on the project, you might choose an auto body grinder, a belt grinder, or a bench grinder. Remember to always be careful and take it slow: Haste is not your friend when you're using a grinder.

Auto Body Grinders

Auto body grinders, also known as angle grinders, are very versatile tools for removing thick grunge and rust. In addition to standard abrasive grinding wheels, you can use a variety of other attachments. These include fine and coarse wire wheels, cup-shaped wire wheels, sanding discs with sandpaper or coarse scrubbing material, and flap discs.



A basic auto body grinder doesn't cost much, but get a good one. You can use flat wire wheels, cup wire wheels, grinding wheels, and sandpaper flap wheels on these versatile tools.

A cup wire wheel has multiple twisted wire brushes. These are fantastic for removing thick coatings of grunge, paint, and anything else. This tool also removes the flesh from your bones nearly instantly, so be careful when using it.

This professional-grade belt grinder is worth the investment if you plan to do much fabrication and metalwork. Cheap belt grinders take forever to get anything done.

Of all these, the wire cup wheel is generally the best for simply removing large amounts of material from an iron or steel surface without damaging the underlying metal. Coarse scrubbing discs also work well while protecting the metal underneath the paint or grunge. Plain bristle wire wheels are good for light-duty removal, such as spray paint, and knotted wire wheels work well for tougher jobs.

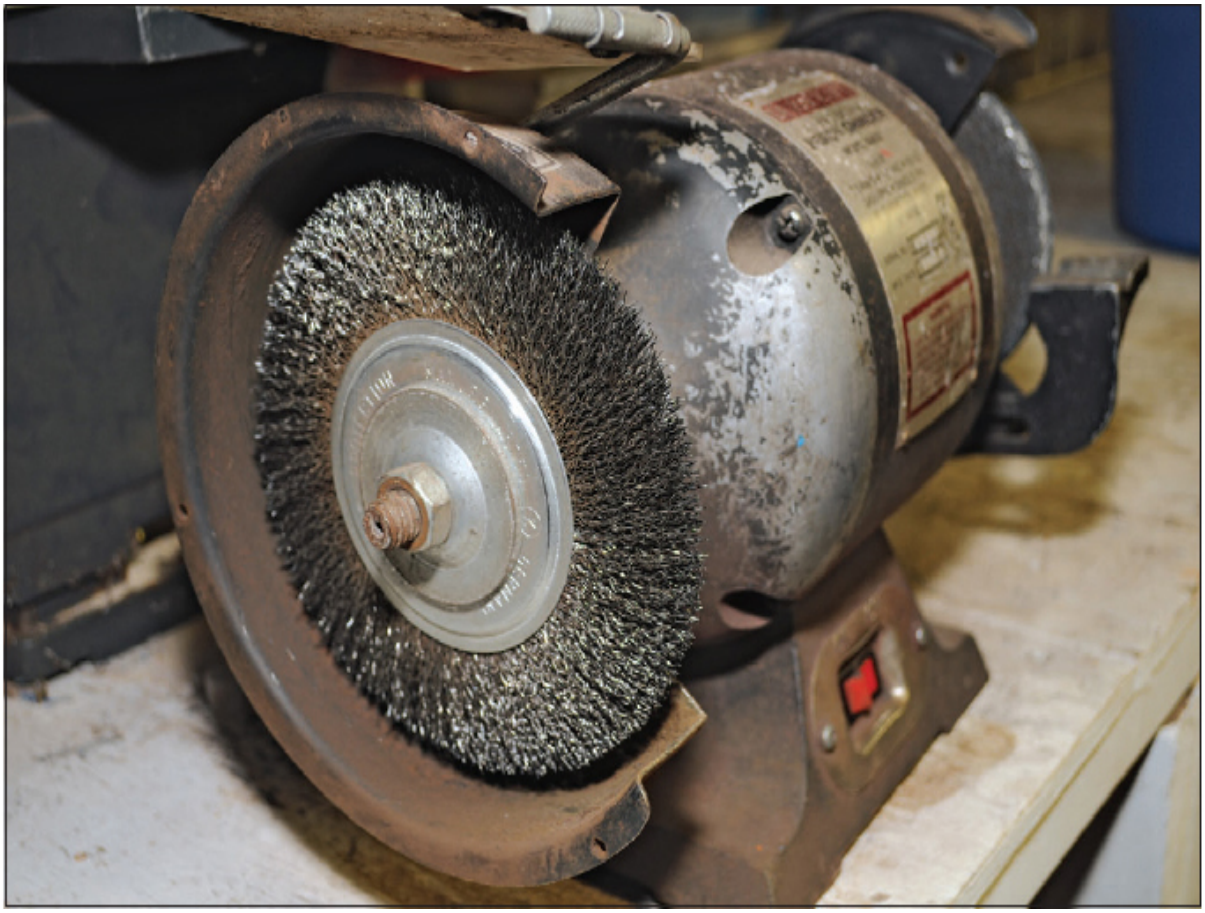
Flap discs are made of overlapping sheets of extra-tough sandpaper, and these are a great alternative to hard abrasive discs. In general, if you're careful and don't press too hard, a flap disc removes rust and paint without gouging or removing too much metal underneath.

If you have metal-filler restoration products for filling grinding gouges, you can go ahead and use an abrasive grinding wheel with your auto body grinder to really dig in and take the part down to its good metal.

Belt Grinders

Benchtop belt grinders have an important place in rust removal but not so much with grunge or paint. These grinders typically have flat faces and at least one curved surface to remove material quite quickly. Use this type of grinder to strip rust or thick, hard coatings, such as old powder coating.

Belts come in a variety of grits, and you should choose the finest grit that works for your purpose. The cleaning work takes a little longer, but the process removes less metal from the part.



The bench grinder is a tool no shop should be without. Buy a powerful one with at least one wire brush wheel. Chances are good you'll buy a second one to go with it.

Bench Grinders

The best use for a bench grinder as a parts cleaner is with a wire wheel. Put a soft wire wheel on one side, and a stiffer wheel on the other. If you have more than one bench grinder, consider adding a buffing wheel. Wire wheels on a bench grinder are ideal for removing rust from small parts; they're much better than a drill-mounted or handheld wire brush.

Sanding

You can do a good job of cleaning parts with sandpaper or a power sander. Each method has its benefits, depending on the project at hand.

Hand Sanding

With sandpaper, you want to use a sanding block for flat or smoothly curved surfaces. Use a staple gun to attach sandpaper to a piece of 2 x 4 for the perfect sanding block. For irregular surfaces, your hand may work better, but you have to be careful.

Auto body workers use the following technique for getting even sanding results: Place a piece of sandpaper over the part and press down with your flat hand. If you move your hand forward and back in line with your fingers, you create grooves in the metal where your fingers put pressure on the sandpaper. Instead, always move the sandpaper in a side-to-side motion to keep even pressure on all points.

Power Sanders

A variety of power sanders create the best solution for prepping parts. Palm sanders are used for finish work and fill the same function as a sanding block. Orbital sanders are large and flat, which helps avoid digging in too much in one place. Disc sanders are tricky to use because it’s easy to dig a big curved groove into your part. Be sure to keep the sander flat against the part, and practice a lot before disc-sanding a vital part. Handheld belt sanders have the same issue; they make it easy to cut a groove into the part.

A palm sander is a good compromise between hand tools and power tools. This one allows you to poke holes in the sandpaper so the tool can vacuum out the dust. A small bag attaches to the tool for dust collection.

Media Blasting

Media blasting is also called sand blasting because sand is the most common media. But you can also use ground nutshells, baking soda, glass beads, plastic beads, or other materials. The basic process is simple: The media is blown at the part and hits it hard enough to remove paint, grimy build up, or even materials (such as body filler or lead) that have been used to smooth gaps and holes in the material.

Never use media blasting on items made from thin, stamped sheet metal. The blasting action stretches and warps the metal. Save this treatment for rigid parts such as wheels.

This wheel from a vintage Mini Cooper was the main project for a media blaster outfitted with glass beads. The beads are small (like sand grains); this wheel has some dirt, but mainly a couple coats of old spray paint on it. I could have used some stripper, but this is a good blasting test.

The wheel was perfectly clean when I was done, with a satin finish from being bombarded with all those beads for about an hour.

The blasting work was slow going with a Harbor Freight blast cabinet, but the results were great. It just takes some patience and a big compressor to run the required amount of air through the system.

Once again, this project proved that the most important factor for a good powder coating finish is doing a good job on the prep work. This wheel will carry that shiny blue coating for decades, and look just as good as it did when I took it out of the oven.

You can perform effective media blasting in your home workshop. A shop-size abrasive blast cabinet, or bead blaster, is a metal box that sits on your workbench. Also available are small plastic-bodied cabinets and large benchtop or freestanding metal cabinets. These cabinets have glass windows so you can see inside, and integrated rubber gloves so you can handle the parts without blasting your hands.

You can purchase a cabinet for less than $150 but there are related expenses: You need an air compressor that can keep up with the demands of the blaster. An inadequate compressor means that you need to pause every time the pressure falls below your working needs. Also, there is the expense

of the abrasive compound, gloves, and window glass, all of which need replacing over time.

Most cabinets come without the air hose and fittings necessary to connect it to the compressor. Also be prepared to visit a hardware store for a pressure regulator. In addition, sometimes too much pressure prevents the media blaster from vacuuming up the media; if you're not getting good results, reduce the pressure a bit.

Media blasting removes grime, paint, and rust very nicely, but you should always start with parts that are as clean as possible. Take the time to scrape and brush the worst of the grunge off the parts before you blast or you end up replacing the abrasive compound frequently.

The best abrasive material is glass bead. This is a clean, fine powder that is gentle on parts. Using dirty or cheap abrasive compound can embed ferrous particles into the surface of aluminum or stainless steel, which can rust and cause problems.

Commercial Media Blasting

Commercial media blasting is useful primarily for large items that you are not likely to powder coat at home. It is also popular for items that you may be coating at home, such as wheels and suspension components.

If you do use a commercial blaster, always insist that they use walnut shells, plastic beads, or soda on lightweight items. These lighter media types remove surface rust, but not deep rust. If you have deeply rusted project parts, you may need to pursue more extensive restoration on the parts before you continue with the powder coating process.

The best news is that commercial media blasting on small items is not expensive, and you may find that it's a great way to reduce the time it takes you to prepare your projects. Plus, commercial blasters almost always obtain better results.

Media Blasting Cabinets

An air-powered media blasting cabinet is a useful tool. If you have to take paint off metal, there's nothing like a blast cabinet. You can purchase a freestanding or a benchtop version at a tool supply store.

Freestanding cabinets accept items up to the size of an exhaust header or loose wheel. Bench-mounted blast cabinets are usually made from injection-molded plastic. They are great units because they are portable and keep the blast media in the cabinet effectively.

Buying a Media Blasting Cabinet

Many people have purchased blast cabinets, used them once, and then left them until they decide to get rid of them. You can often pick up a lightly used Harbor Freight blast cabinet for $40 to $75 on craigslist, including the air fittings and a bag of beads large enough to last for years of regular use.

This blast cabinet is big enough to take valve covers, exhaust manifolds, and smaller wheels up to about 15 inches in diameter. This cabinet, with everything you need, can be purchased from Harbor Freight tools.

Freestanding and some benchtop blast cabinets usually have to be assembled from parts made of stamped sheet metal. Some foam-rubber gaskets are included, but they don't work well so these cabinets leak tiny glass-bead dust everywhere. You can get around this with a tube or two of clear silicone RTV. Use the RTV to seal each joint as you assemble the cabinet.

You also want to add a filter to the outlet vent of any blast cabinet. You're putting a lot of pressurized air into the cabinet, and as it vents, the air tends to carry dust and abrasive with it. A filter keeps the abrasive compound inside the cabinet, but be sure to check and clean it frequently.

You can also prevent a big mess by installing an evacuation blower. A sawdust evacuation system from a woodshop, for example, can be plumbed into the blower vent. Then direct the exhaust out of your shop. Otherwise, no matter how careful you are, you end up with a dusting of abrasive glass beads all around your blast cabinet.

When it comes to blasting, less is often more. Don't put more abrasive material in your cabinet than absolutely necessary to ensure a steady supply, and use the lowest possible air pressure from your compressor. If you use too much pressure or too much abrasive, the material does not move through the blast gun.

Also, be aware that the hoses and fittings that come with less expensive cabinets are prone to kink and collapse. You may need to find some reinforced tubing at a home supply store to upgrade these items.

Project: Media Blast Cabinet Installation

Most blast cabinets can be set up and running in minutes. Be sure to cover all cars and other machinery in the area until you know exactly how much abrasive leaks out of your particular cabinet.

Use patience when blasting because it can be pretty slow going. Also bear in mind that your compressor needs a break. Even a small blast cabinet

can keep your compressor running as long as you keep blasting, and your compressor needs some down time to cool off.

As much as possible, use the blast cabinet to remove paint, rather than dirt, grease, and grime. This helps keep your abrasive material dry and usable longer.

Project Details
Cost About $75 to $300
Time to build **About an hour** **Tools** Screwdriver (if disassembled)
Supplies Air hose with a connection fitting that matches your compressor/line
Air pressure regulator with fittings appropriate to your compressor/line
Lighting
Optional exhaust blower

Follow these steps:

1 Find a good spot in your shop to set up your cabinet. You want to select a place where you can look down into the cabinet at a good angle, with plenty of light, and have your arms comfortably fit into the holes provided for the gloves. Also, choose a space with plenty of access to the cabinet's door. Finally, make sure that you have located the cabinet within range of your air compressor.

2 Bring the air hose to the cabinet. Most air hoses terminate in a female connection, so place the appropriate connector on your pressure regulator and a short length of hose on the output side of the regulator, with its own female end.

3 Most blasting guns use a barbed fitting or a male Industrial air fitting. Fit a length of hose securely to the blasting gun, and pass it out through the hole provided in the cabinet, making sure to get a good seal. The rubber grommet around the hole protects the hose from abrasion and ensures a good seal. Be sure the grommet is in place.

4 Connect the gun hose to the pressure regulator and set the dial to about 50 psi to the gun.

5 Pour about 2 to 3 pounds of abrasive into the bottom of the cabinet. You don't need a lot because you change it frequently as it becomes dirty. The bottom of the cabinet is cone-shaped to effectively keep the beads recycling.

6 Connect the draw line to the gun; there is usually a metal pipe with a flexible length of hose. The pipe inserts into the reservoir of abrasive. The flex line connects to the front part of the gun.

7 The gun should have a ceramic tip. Theoretically, this tip is consumed in the course of work, but they actually last a long time. Unless you're blasting every day, it's reasonable to expect a tip to last years.

8 If you have access to an exhaust blower, install it and use the necessary plastic adapters to connect it to the vent located high on the cabinet back. Turn the exhaust vent on and direct the output to the outside of your shop before beginning the blasting process.

9 It is nearly impossible to get good results if you cannot see your work clearly. If you find that you need light, the best answer is a protected light

source inside the cabinet. Stick-on LED lights with battery power work well for occasional use, or simply drill a hole in the side or back of the cabinet and wire in a small fluorescent lamp.

10 Adjust the pressure of the air until you achieve the best results. Guns and cabinets vary. In general, lower pressure ejects less material from the cabinet and is easier on the compressor.

Rust Removal

Rust is one of the more challenging obstacles to good powder coating, but with the right products it's not that hard to remove. You can remove rust by mechanical means including brushing, sanding, and grinding, or by chemical means such as acid dipping or other chemical treatment. Any of these options can be a good choice. One is not significantly better than another, depending on the nature and location of the rust. If the rust is difficult to reach by mechanical means, you are limited to chemical rust removal. Most of the time, and depending on the extent of the rust, you may achieve the best results using both mechanical and chemical rust removal in turn.

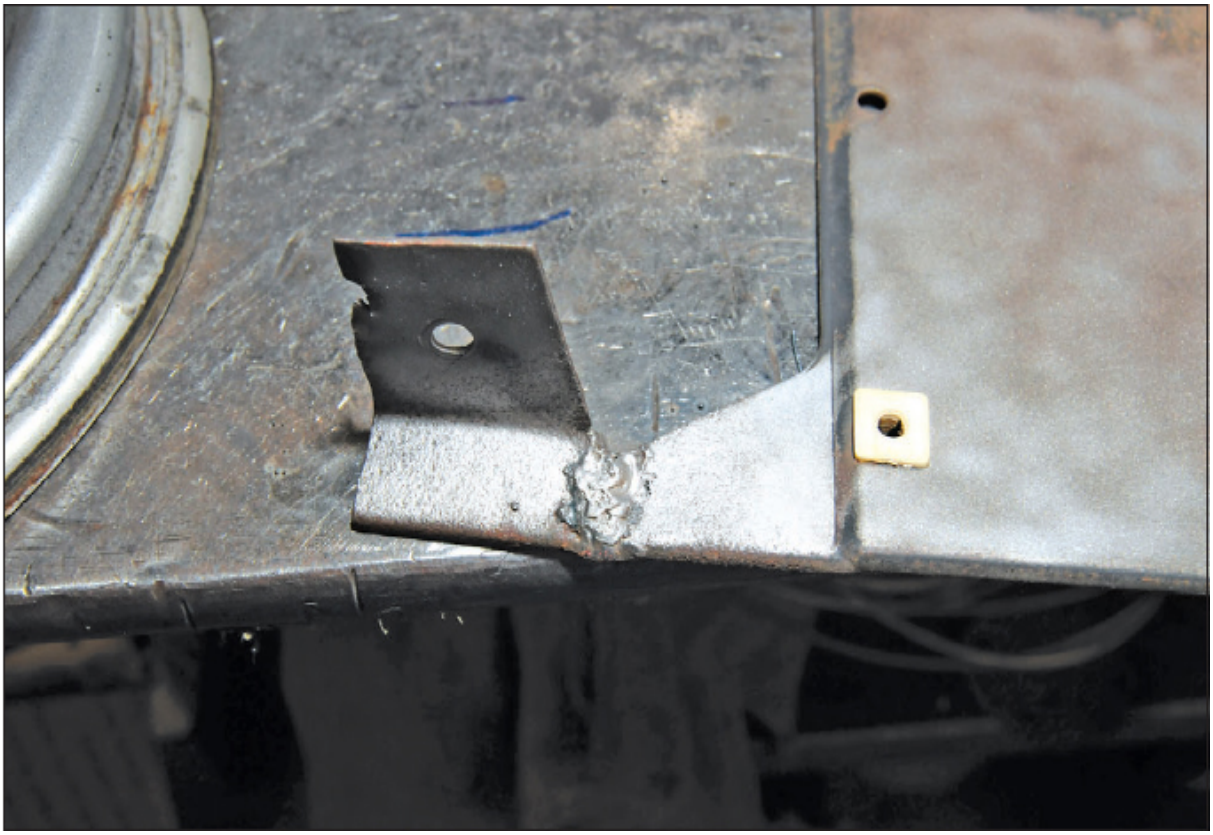
As you remove the rust, look closely at the part. Has the rust gone far enough to weaken the structure, or even just enough to make it pitted and shabby looking? If the part has been weakened, consider using a welder or other means to reinforce the structure. Powder coat fills in some pitting, but if you wish to smooth the part before coating, Eastwood and other manufacturers make metal-based fillers that accept powder coat and survive the baking process.

To test the media blasting cabinet on rust, I chose this engine bay panel from an older Corvette restoration project. This panel has had a previous welding repair, and the whole thing was covered in rust.

Mechanical rust removal is just like any other mechanical cleaning method; it just takes longer because the rust has eaten into the metal instead of sitting on top of it as other grunge does. Be patient and use every tool you have to dig in and get the rust out.

Also, when you have something media blasted, work on it right away, because iron and steel rust very quickly once exposed to the atmosphere.

This panel was a tougher project than the paint on the Mini wheel. Rust stands up better to the glass media than paint. But I kept at it until I got some results.



With the rust removed, I could see the previous weld repair clearly. I will grind it smooth before I coat this part, and will also remove the plastic inserts.

I used the media blaster to remove most of the rust on this panel. I then switched to Eastwood Rust Dissolver to strip the panel, and used a wire wheel to finish it.

CHAPTER 5

PARTS CLEANING EQUIPMENT

As with any process, you can choose from an array of equipment, based on your available space and your needs. The sky's the limit on cost, but it doesn't have to be expensive. A simple benchtop parts washer or a used dishwasher is quite affordable, and if you can get away with it, a good old bucket of soapy water is as close to free as you can get.

Parts Washers

Many different options are available to you when it comes to finding appropriate tools for washing your powder coating projects. These range from a simple 5-gallon bucket to industrial-size hot solvent washers. As you might imagine, the industrial tools work much better than anything you can afford or fit into your home workshop. But you can get good results with a little more time and effort or just take your parts in a batch to a commercial cleaner and pay a little cash for the service.

Having a parts washer is a good idea if you plan to perform powder coating or any surface prep work. Having two or more parts washers is even better because you can put different cleaning solutions in different washers.

Parts washers come in a variety of styles and sizes. Some of the factors to consider before you make a purchase are: size of the unit, how often you plan to use it, what kinds of parts you have to clean, what sort of grunge

you plan to remove, and cost. Also think about whether you need a full-size standalone parts washer or a benchtop unit or both. Then, based on the chemicals you will use, consider whether the body of the washer should be made of metal or plastic/ABS of some kind.

Note that a parts washer uses an electric motor to drive a pump that circulates the fluid through a nozzle. Pay close attention to the solvents you put in the washer because certain chemicals, such as acetone, immediately destroy the rubber parts of the pump and potentially even the body of the washer. Your product documentation should tell you what's safe to use.

It's good to have an old parts washer and a new one. Leave the old one outside for use with harsher cleansers, such as oven cleaner, Diesel fuel, or other flammable or vapor-producing agents.

Workshop Models

Some freestanding parts washers use a filter system and a drum of solvent placed below the washing basin, while lower-cost models are simply a basin full of solvent. Some high-cost units actually heat the solvent, which works great for cleaning purposes, but in addition to the cost, the heating element poses a fire danger. Some states have outlawed solvent-based parts washers, and others have heavily restricted their use. Biodiesel fuel is a great natural solvent. This product dissolves grease and oil-based deposits very effectively and works well in a parts washer.

The highest-end parts washers are like giant dishwashers, and use boiling water and detergent to clean large parts such as engine blocks. A shop dishwasher simulates one of these cleaners on a small scale.

You may wish to put the parts washer outside if you use solvent in it, because it gets dirty, and if you fill it with mineral spirits, gasoline, kerosene, or Diesel fuel it poses a vapor and fire hazard.

If you would rather not have a large parts washer filled with dangerous chemicals, you can always take your parts to a machine shop or parts-cleaning business to be washed. As a rule, machine shops probably charge a little less for small and infrequent cleaning jobs, but parts cleaning businesses are a better deal for larger lots and frequent work.

Detergent-Based Benchtop Unit

If you happen to be working out of a small garage, you may not need or have room for a large, expensive parts washer or dishwasher. A small benchtop unit may be the answer.

You can easily obtain water and detergent-based cleaners in a kit with a plastic-bodied benchtop washer. These are inexpensive and quite functional. It's also nice that they are designed to sit on your workbench because you're going to have to put in a bit more elbow grease with a detergent solution to remove the grunge.

Oil Eater makes a very affordable and functional benchtop parts cleaner. The washer is compact, simple, well constructed, and stores out of the way when not in use. This washer includes a tube with a cleaning brush attached to the pump. The Oil Eater detergent solution flows through the brush, making it easier to clean off and wash away the dirt and grime, and does not emit much of a smell. The overall washer unit is made from high-impact industrial plastic and features a removable metal lid and a heavy-duty pump that resists corrosion.

Washbasin Washer

An alternative to a benchtop parts washer is to use your garage washbasin. The tradeoff here is that you go through far more detergent solution. If you are careful about your precleaning, the solution in a benchtop parts washer should last a good long while. One big advantage to a washbasin is that you can use hot water. Hot water makes the task dramatically easier, especially if you're removing grease and oils.

To set up the Oil Eater washer, you just follow the instructions. In the tank, mix up 3 gallons of solution: 50-percent water and 50-percent Oil Eater. That is enough water/detergent solution for the pump to safely wash parts vigorously without getting the cleaning solution all over the counter and the floor.

If you do spill some, remember that it's just detergent and water, so you can clean your bench and floor at the same time you mop it up. If you're about to clean parts and you do not have your detergent mixed, use the hot water tap to fill your parts washer and immediately get to work. Heat really helps loosen greasy grunge.

Another plus with a benchtop unit is that it is completely portable, so you can pick it up and take it anywhere. Just set it up on a table and plug it in. If you don't have electricity, you only miss out on the pump. You can still soak and scrub as usual.

Kitchen Dishwasher

One of the most effective parts washers is an ordinary kitchen dishwasher. These combine detergent, very hot water, and spraying action to get parts extremely clean.

An old dishwasher can be found very cheap on craigslist, your local ReStore, or you may find a working unit from a friend. Ask around; people replace perfectly functional dishwashers all the time. If word gets out that you like old dishwashers, you'll probably have people leaving them on your front lawn. At most, you may have to pay $20 for a good one. Make sure that the seller includes the drain line and inlet line with the unit, but if they don't or the parts are not suitable for use, new lines are not expensive.

The main thing to look for in a used dishwasher is that the plastic tub is intact and that the door still seals. If the tub is cracked, keep looking. Ideally, the dishwasher would still be connected and the seller would be able to demonstrate it working.

When you have your dishwasher, look at the parts you want to wash. If you want to wash big things, consider cutting out the plate stands from the lower basket. The upper basket is usually removable, but keep it around in case you need to wash a bunch of small parts.

You can use any dishwasher detergent you like; I've heard rumors that some phosphate-free detergents discolor or damage aluminum parts, but reports are mixed. If that worries you, don't wash any part in your dishwasher that you couldn't bear to see stained.

Project: Cleaning Parts with a Kitchen Dishwasher

A kitchen dishwasher is an effective tool for cleaning parts in preparation for powder coating. It's important to properly install the dishwasher in your workshop so be sure to install the correct water supply hoses and drain hose. Once the dishwasher has been used for parts prep, do not use it for conventional dish washing.

Project Details

Cost

A few cents' worth of dishwasher detergent

Time to build

About half an hour

Tools

Dishwasher

Supplies

Dirty part

Automatic dishwashing liquid

Follow these steps:

1 Place your old part in the dishwasher, bearing in mind that you probably don't want water and/or soap to pool in it any more than absolutely necessary. The spraying action comes from below, so face the dirtiest side down.

2 Use your preferred detergent in the recommended amounts for a load of dishes. You don't need to go overboard. I like Cascade dish detergent because it has an effective grease cutting ingredient.

3 Run the normal dishwasher cycle; you can shorten the drying cycle. You need to take the part out and completely dry it anyway. Remember to turn it over to make sure all water has drained out of all nooks and crannies.

For this project, I used an aluminum cam cover from a Mazda Miata. Like most such parts, it was pretty clean, but had some oil and dust on it from normal use. The part came out perfectly clean and without staining. After drying overnight, it was ready for powder.

This Miata cam cover is a typical automotive part. It was never coated or painted at the factory, and it's been in an engine for more than 20 years. So there's some oil and dust, but nothing too major to clean off.

You can see the oxidization, or residue, on the surface of areas of the cam cover. I wanted to get rid of this oxidation before washing, so I used metal prep to dissolve it.

After solvent was applied, a powder developed on the surface, which was then easily brushed away. I also removed some of the screwed-on metal plating from the underside before putting this part through the dishwasher. The results of this project can be seen in Chapter 8.

Dishwashers are great for gunk that melts away and responds to detergent, but don't expect it to get rid of baked-on hardened material stuck in corners and crevices. For that you really need to get in there with mechanical tools (dentist picks, wire brushes, and so on) to remove the material.

Use common sense. If you have a part with 1/2 inch of gritty, yucky buildup on it, chances are that a trip through your dishwasher won't get it all off the part, but it will remove enough of it to clog the dishwasher drain! Scrape or brush your parts as well as possible and let the soap and boiling water dissolve the stuff you can't clean off by hand.

One final note: If your part has crevices, sometimes detergent gets trapped in there. Be sure that you've inspected the part for excess dried detergent, which appears as a white powdery substance. It rinses away with clean water, so it's easily fixed.

Project: Testing Different Cleansers

This project seeks to determine if any common household or garage cleansers work much better than others, or if any particular cleanser should be avoided. You can easily repeat this test in your own shop, although the results I obtained indicate that the matter is pretty well settled.

For this project, I sourced six different commonly available cleansers, and found a supply of identical, dirty steel washers. Each washer was about 3 inches in diameter and 1/8 inch thick, and was covered in old oil and grimy grunge.

Carburetor cleaner comes in spray cans or in a big can like this. A can comes with a little basket that allows you to submerge parts and easily retrieve them. This is a good product for a long soak to remove old fuel varnish and grunge. It's safe to use on aluminum and pot metal parts.

Project Details

Cost

About $20

Time to build

About an hour

Tools

Pie tins

- Lettering dies
- Chemical-resistant gloves and eye protection

Supplies

Items to clean

- Windex
- Acetone
- Carburetor cleaner
- Foaming engine cleaner
- Brake cleaner (TCE)
- Oven cleaner
- Paper towels

I stamped each washer with a letter using a die, and then matched it up to a particular cleanser. I selected Windex, acetone, a carburetor cleaner, a foaming engine cleaner, a brake cleaner, and an oven cleaner.

Follow these steps:

1 Place six pie tins on your workbench. You can label them, or just set the relevant cleanser bottle behind the tin to keep them identified.

2 Stamp each dirty washer (or similar part) with a letter (I used A through F). This helps you to keep track of the washers through the cleaning and coating process.

3 On a pad of paper, note which washer is cleaned with which product.

4 Wash each washer in turn with the product you selected. Give it time to soak, and then wipe the washer clean and dry.

5 Select a powder. I chose clear gloss so I could see through the powder to the metal underneath to inspect the adhesion. Then powder coat all six washers on both sides.

6 Hang the washers in the curing oven (a toaster oven worked well in this case) and bake the coatings according to instructions. When the curing process is finished, take the washers out of the oven and examine them for adhesion and finish.

After I tested the six household cleaners on the dirty washers, I hung them up and coated them all at once. Because I had stamped each of them and made a note of which cleanser went with which stamp, I was able to keep track of them after the coating process.

My results were generally good. Each of these cleansers produced a surface suitable for powder coating and achieved good adhesion. I could have coated a seventh uncleaned washer as a control piece, but you already know what happens when you coat dirty metal.

I hung the washers in the toaster oven to cure them. The clear coat goes on looking almost white, but becomes transparent quickly when the powder first melts in the curing process.

The lesson here is that most household cleansers remove dirt, oil, grease, and grime. You don’t need expensive cleaning agents or elaborate processes; you just have to get the parts clean.

All of the common cleansers produced a good result. The powder coat stuck to the metal perfectly and remained clear in all six cases. The lesson is that it matters less what product you use, and more that you do a diligent job of cleaning.

Environmental Concerns

If you choose to use a kitchen dishwasher as a parts washer or a benchtop detergent-based parts washer, you need to be sure that the outflow from those appliances doesn't cause an environmental problem. Rules vary by location and the nature of your sewer system, so you should get specific information from your utility company for your area.

Although most water and detergent-based solutions are nonflammable and nontoxic, they can qualify as hazardous waste after you use them because they may then contain toxic metals from the parts and grunge cleaned off in the parts washer.

As you use your dishwasher washbasin, or detergent-based parts washer, keep in mind that grungy car parts are full of hazardous chemicals that should never go down the drain into the environment. Sewer systems are built to handle a small amount of grease, dirt, etc.,

but too much motor oil or old gasoline is not healthy and may subject you to civil or even criminal liability. In addition to the many environmental and groundwater problems this causes, it can also result in dangerous sewer pipe explosions.

The best thing you can do is to scrape, brush, or blast off all the seriously greasy grunge from your parts before you use any cleaning solutions. Before you use your dishwasher, parts washer, or washbasin for cleaning parts, make sure they've been scrubbed as clean as you can get them to minimize the amount of crud going into the sewer. This also helps keep your dishwasher from getting clogged up.

You can buy replacement filters from parts washer supply businesses. These remove the particulate matter and sometimes the oil from your outflow. You can dispose of the used filter elements as you would a used oil filter. Filtered wastewater can go down the sewer in some areas, but check with your local sewer system before you put anything down the drain.

If your work is just too dirty and will yield a lot of grimy, oily wash water, consider investing in a 55-gallon drum to collect the waste products. Each time you run your dishwasher, it uses between 4 and 6 gallons of water. The best thing you can do is to run the dishwasher discharge (the wastewater) into the drum and dispose of the drum when it is full. You can usually have this drum emptied by a professional who services auto repair shops, or find the hazardous waste disposal area at your local dump or recycling center. ■

Project: Dishwasher Installation

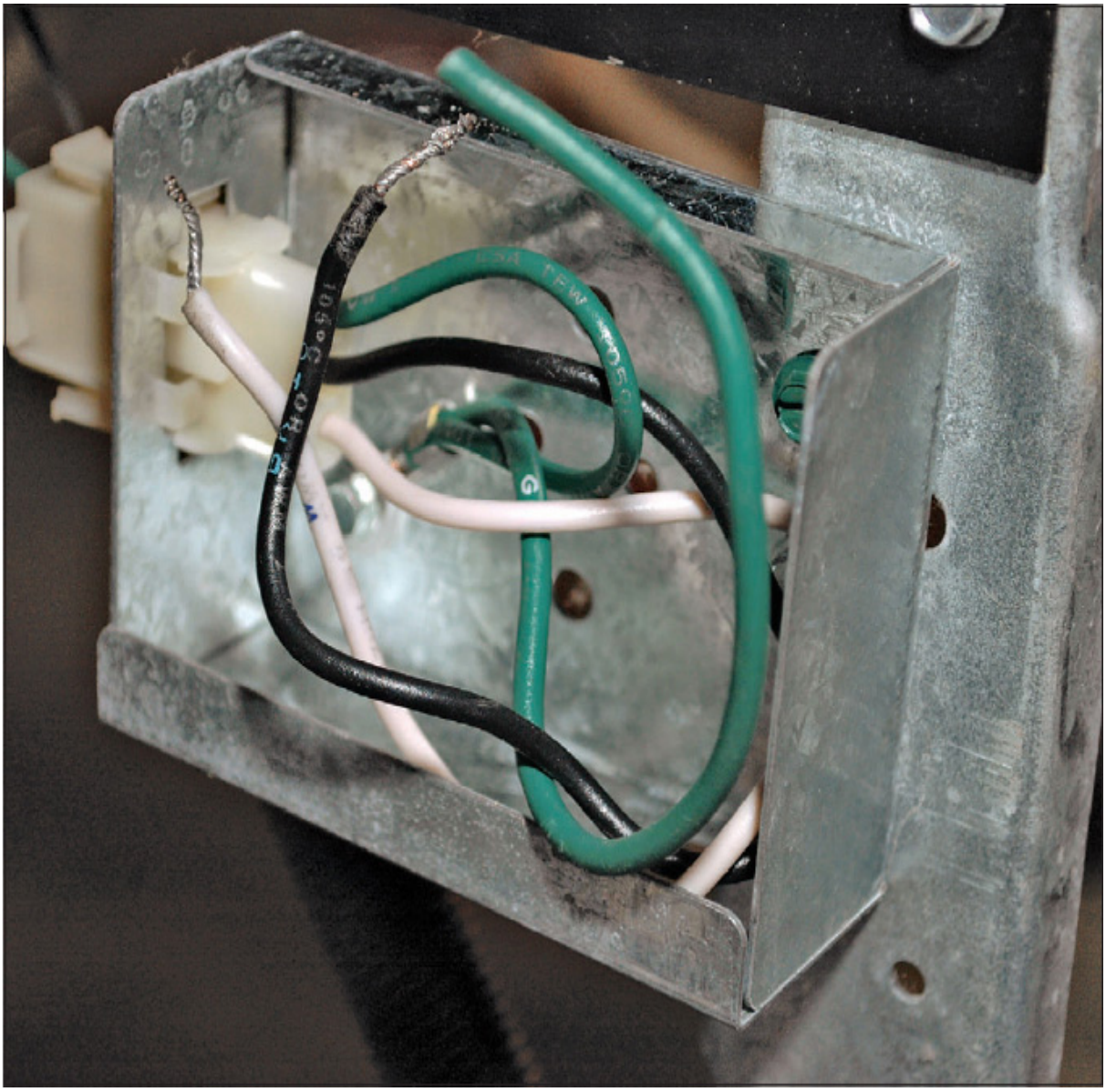
Setting up a dishwasher is easy; the connections are simple, although getting everything connected and working properly can take some creativity and work. But once it's set up, a dishwasher in your workshop should last a long time provided you use it and care for it properly.

Project Details
Cost **About $40, including the dishwasher** **Time to build** **About two hours** **Tools** **Circular saw** Hammer and nails or power driver and screws Tape measure Crescent wrench
Supplies **2 x 4 boards** 1/2-inch plywood 16d nails or 3-inch heavy construction screws Dishwasher inlet kit Dishwasher drain kit

Follow these steps:

1 Dishwashers are designed for installation under cabinets. They're unfinished and ugly without something around them. Use lumber and plywood to build a simple cabinet around your dishwasher. You can also go to a used building supply store and buy a kitchen cabinet designed for a dishwasher; it serves as an additional storage shelf or a great little workstation for a benchtop parts washer.

2 You don't need a dedicated circuit for your dishwasher, but you do need a functional 120-volt outlet, preferably on a 20-amp circuit. Make sure you have an appropriate electrical outlet for the machine. Most dishwashers have been hardwired into homes, but all should have connections to allow you to attach a premade plug cable, or you can use metal-clad cable and hardwire your dishwasher to the wires in the outlet box and omit the plug.

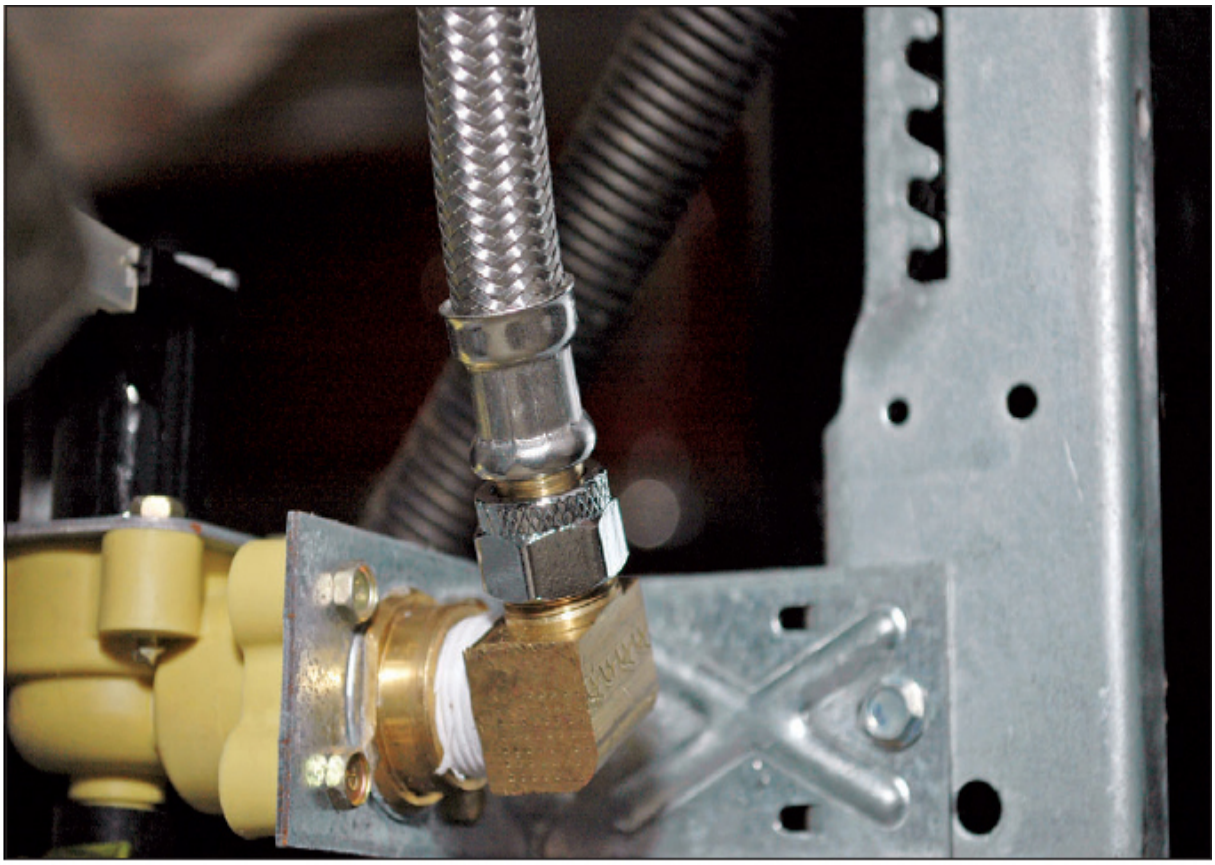


Some dishwashers are hard-wired to the house circuitry, while others use a plug. There's always a little box where the wiring is connected, and you can install a grounded plug if yours didn't come with one.

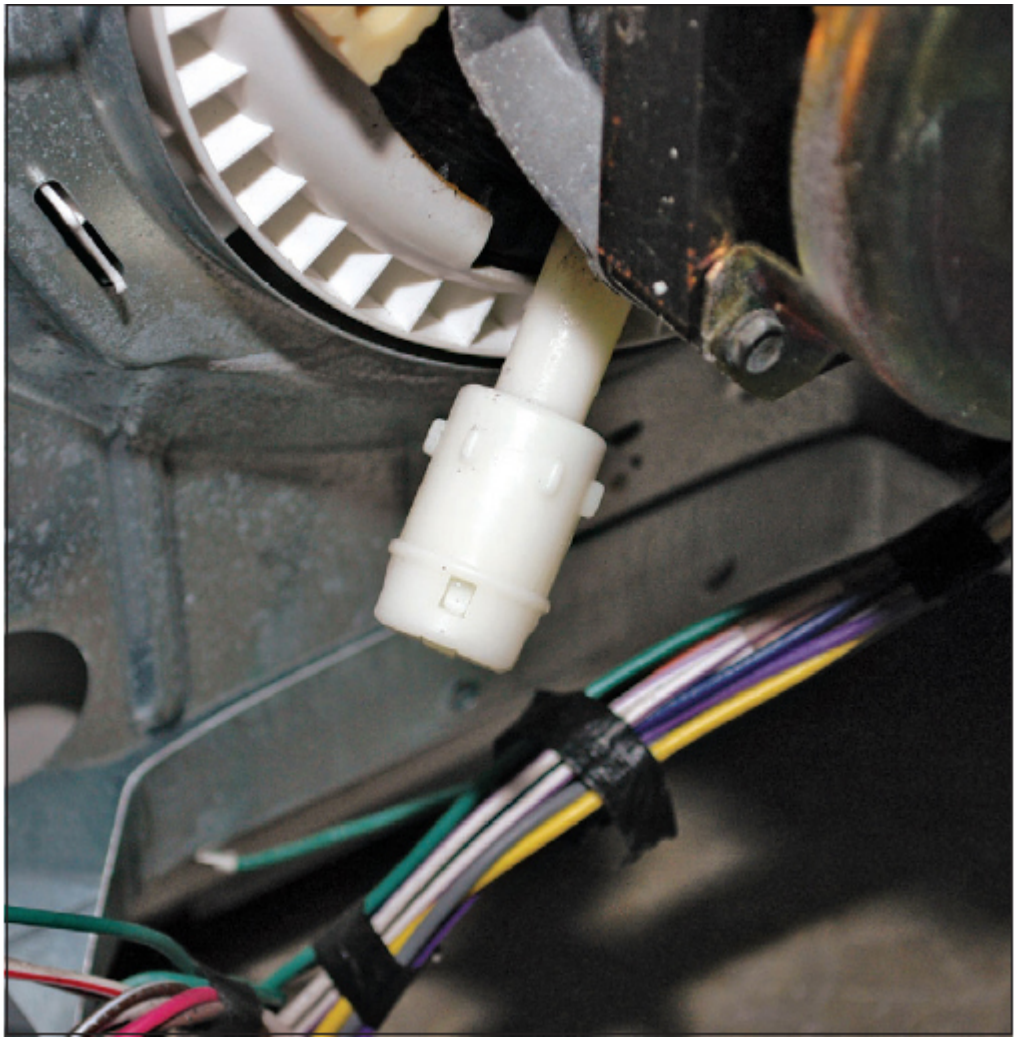
3 The dishwasher inlet takes cold water. Do not run a line from your hot water heater to a dishwasher; the dishwasher's internal heating element heats the wash water. The inlet is generally a 3/8-inch compression fitting, and copper pipes are the usual water source, but you can get a flexible nylon pipe at any home supply or hardware store, and these are generally easier to install without leaks.

Note the format of the inlet pipe and make the appropriate connection to your water source. You can also supply water to your dishwasher using the same cold-water valve that supplies your washbasin by using a dual-outlet valve. You can buy one at your local hardware store.

4 The dishwasher outlet takes a flexible line with rubber ends; it's a press-fit on a barbed fitting under the dishwasher. You can run the line over the side of the washbasin with an appropriate attachment, or into the tailpiece in the drain of your washbasin, or straight into your drainpipe, depending on how your plumbing is set up. If you run the drain into the tailpipe of your basin, you might need a hose clamp to get a good seal.



Connect your dishwasher to cold water only; the machine heats the water. This is a pressurized connection to the dishwasher's inlet valve.



The outlet tube looks like this. It's not pressurized, so you can safely use a slip-on hose to the drain tube to get rid of the used water.

To drain the dishwasher, simply attach a dishwasher drain spout to a drain line and run the line to your workshop or garage sink or basin; you can also run the line to the laundry drain or any sewer drain.

CHAPTER 6

CLEANING AND REPAIRING SPECIFIC METALS

Most items to be cleaned for powder coating are made of iron, steel, or aluminum. A variety of other metals are also used, including brass and copper.

Different rules apply when cleaning various metals. Some of the stronger chemical cleaners destroy aluminum-based alloys, for example, so it pays to know which metal you're cleaning and which product is best for it. Because each part is different, you may need to adjust your process. Soon you will be able to look at a part and tell what tools and supplies in your arsenal will get it perfectly clean.

The projects in this chapter came from parts bins and other sources to be processed for powder coating. They are representative examples of what you might undertake.

Different metals have very different characteristics when it comes to cleaning and repair. Some cleaners dissolve aluminum, such as this intake manifold, in a very short time. Plus, you can't weld aluminum with a welder made for steel, and vice versa.

Iron and Steel

The upside to cleaning iron and steel is that very few products attack these metals with the ferocity that caustics attack aluminum; you're certainly unlikely to find any of these caustics in your garage!

The downside of iron and steel is that rust is prevalent. As mentioned previously, a couple of basic chemical products work on rust: phosphoric acid–based naval jelly (also called etching solution) and urea hydrochloride–based rust dissolver.

Cleaning Deep Rust

For this sample deep rust project, I selected the bottom cap from a welding tank. Because water often condenses in these tanks, the bottoms can become quite rusty. Because this part formed a natural bowl, both chemical and mechanical processes could be used to strip it.

I started by chipping away loose rust with a scraper, and then followed up with a good soak in Eastwood Fast Etch to let the acid work on the rust. When the acid was neutralized, I used an auto body grinder with a wire brush cup attachment to remove the remaining loose material.

Remove Contaminants and Surface Rust

With an iron or steel project, the first thing you need to do is remove any grease or dirt, and then take care of any surface rust. I like to use a multi-step process:

1 Remove the worst dirt and grime by scraping, brushing, and physically removing material stuck to the surface. There's no use wasting chemicals to eat through layer upon layer of greasy dirt. For this step you need to put some muscle into it. A pressure washer or outdoor sand blaster can make your life a little easier in this phase.

2 Wash off the fine dirt and grease. Next, go to the parts washer to remove the last of the grime by soaking and scrubbing. A trip through the dishwasher should do the trick for the last of the grease.

3 Use a paint stripper to remove any paint or previous powder coat. Rinse thoroughly with clean water.

4 Now that the extraneous gunk is gone, the acid- or urea-based chemicals can do their jobs on rust. Don't forget to rinse and then dry the part immediately after treatment. You might have to get in there with an angle grinder with a cup wire wheel or other physical cleaning tools. Be sure to rinse off all chemicals first, or you'll be flinging caustic chemicals all over your shop!

5 Scuff the part with a clean wire brush, emery cloth, or some other abrasive to remove the last bits of rust and paint.

6 Finally, wipe down the part with Eastwood PRE Painting Prep or a similar product. It evaporates and leaves no trace, so you have a perfectly clean surface for coating. ■

Here's the bottom end of a welding bottle from the bell project. The outside has a combination of rust, paint, and a little dried concrete that once stuck to the bottle.

The inside of the bottle is crusted with rust from years of pressurized gases generating condensation on the metal. This will be a major task of rust removal.

Eastwood
DO THE JOB RIGHT.
FAST ETCH
ACID-BASED RUST REMOVER
AND METAL PREP
• Ideal Prep for Painting and Powder Coating
• Leaves Zinc Phosphate Coating
• Non-Flammable, Non-Corrosive and Non-Toxic
CAUTION! MAY BE HARMFUL IF SWALLOWED.
KEEP OUT OF REACH OF CHILDREN.

I selected Eastwood Fast Etch for this project. I simply filled the cup with the etching solution and let it work for a while.

Cleaning a Steel Part

For a steel cleaning project, I chose the bottom portion of an old welding tank. This tank had been cut into pieces to create outdoor wind chimes and would benefit greatly from a protective powder coating.

Because of the high-quality paints used on welding tanks, chemical paint removers had no effect. The best cleaning process for this part was an

auto body grinder with a wire brush cup, followed by a wipe-down with Eastwood PRE Painting Prep.

Fast Etch converted the rust to a black crust. I could have coated it at this stage but elected to use the wire cup brush and get down to bare metal first.

The outside of this bottle was rusted; it took a while with the cup brush to get this paint off and down to the base metal.

You can see the difference between an area that has been thoroughly wire brushed (toward the bottom) and one that has not yet been touched (top). There's plenty of work yet to do before this project is ready to coat.

This bell is part of an art project I'm working on. It's made from the bottom of an old welding bottle. It has rust on the inside and multiple layers of paint on the outside, plus the welding beads to secure the hanger on the top.

This part was too big and heavy for media blasting, and the paint resisted the stripper, so I cleaned it with a wire cup brush. Note the striated markings from the manufacturing process. Check the project results in Chapter 8.

Cleaning a Cast-Iron or Steel Part

Cast iron rusts differently than other forms of iron or steel and responds well to chemical-based rust removers. For this project, I picked an old brake disc. Because these are subjected to daily heat cycles, they tend to rust everywhere that they are not constantly scrubbed by the brake pads.

The solution was Eastwood Fast Etch, which removed the rust, and then a good sanding and wire brushing. Brake pads leave a layer of residue, so if you are planning to coat a brake disc, be sure to use the sandpaper step.

It bears mentioning that because brake discs routinely become hot, it's not appropriate to coat a disc that will actually be used to stop a car. But if you're making sculpture, go ahead.

Aluminum

When you remove the grease or dirt from an aluminum part, remember that aluminum and its alloys are lighter and softer than steel, so be careful not to abuse them with tools such as an angle grinder and wire wheel brushes; they dig right in and chew up the metal.

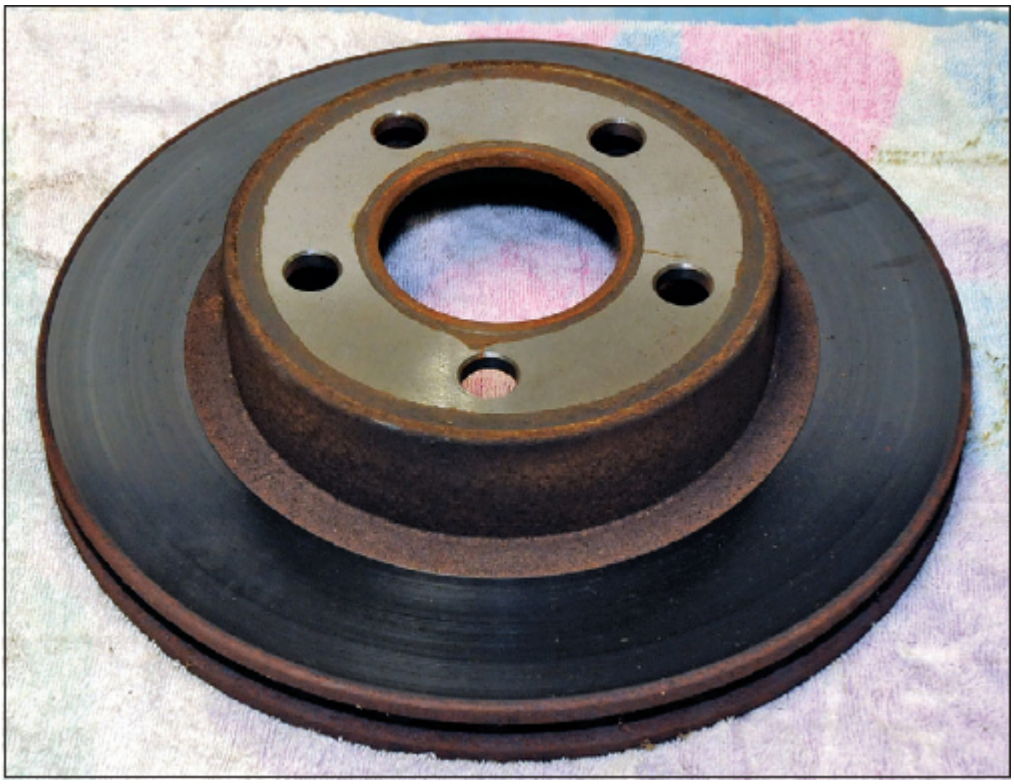
Also, aluminum and pot metal are very sensitive to caustics; they eat the metal like pouring paint thinner into a Styrofoam cup. Be sure to use methylene chloride cleaners on aluminum parts. Also, make it a habit to read the label on any chemicals you might use on aluminum; the packaging states whether they can be used on specific metals.

Cleaning an Aluminum Part

For an aluminum cleaning project, I chose a used bell housing from a Corvette transmission. It was caked with oily gunk made of leaked and cooked engine oil mixed with dust from the clutch disc.

I first applied oven cleaner, which loosened the material somewhat, but didn’t come close to removing all of the accumulated gunk.

Next I soaked the gunky areas in a detergent-based parts washer, which helped a bit more, but still left it far from finished. With the investment of time and effort balanced against the relatively low (about $20) cost to have this part professionally cleaned, I elected to send this one out for cleaning.



This old Subaru brake disc has cast-steel rust. The constant heating and cooling of parts such as this and their exposure to the elements lead them to rust quickly.

I used Fast Etch on this project, but the effect was different from the welding bottle project. After I painted the etch onto the brake disc, the heavier powder rust on the hub came right off, but the etchant left gray spots on the polished face of the disc.

Remove Aluminum Oxide

Before cleaning aluminum, learn to recognize aluminum oxide; it is the aluminum version of rust. If the metal feels rough and is dull gray or whitish in color, oxide has formed on the surface. You want to get rid of that before coating.

Here are the steps for a reliable general procedure:

1. Use a Scotch-Brite pad and simple soap and water to remove aluminum oxide. An alternative is to use “Aluminum Jelly,” which is based on phosphoric acid; it easily removes oxidation and films that develop on aluminum.

2. Rinse off any residue.

3. Dry the part.

4 Apply a paint prep solution as soon as possible to protect the bare aluminum from the oxygen in the air.

Aluminum can look brilliant with the correct procedure. In fact, aluminum parts are great candidates for clear matte or gloss powder coat. If you clean the aluminum and then powder coat it with a clear product, your aluminum will shine, be easier to clean, and be protected from oxidation. ■

This Corvette bellhousing has years of baked-on grunge on its inner face. Grunge made of oil and clutch abrasive material is notoriously hard to remove.

I took this project outside to the old parts washer because using oven cleaner would likely create fumes. The oven cleaner worked pretty well, but it's still going to take a lot of work before I can coat this part. Maybe it's another candidate for professional cleaning instead.

Other Materials

You can easily powder coat any metal that conducts electricity, which opens the door to coating copper, bronze, pewter, tin, and a wide variety of other materials, including those that have been plated with cadmium, nickel, chrome, or even silver or gold.

Cleaning a Brass or Copper Part

For cleaning brass, you need a chemical that removes the oxidized metal and impurities that form tarnish. Products such as Tarn-X are readily available at the grocery store, but Eastwood's Rust Dissolver works perfectly on copper. Since both are a mixture of acid and urea, they work essentially the same way.

Simply coat the copper or dip it in the tarnish or rust remover for a few seconds; the process on copper is amazingly fast. You may still need to scrub to remove foreign materials such as paint or gunk from the copper, but this is easily done with a Scotch-Brite pad or steel wool.

I tested Eastwood Rust Dissolver on copper because it's acid-based and found that it works just fine as a copper cleaner and tarnish remover. Products such as Tarn-X and other tarnish removers use the same basic ingredients as rust remover.

This basic 120-volt welder is available at Harbor Freight tools. It is the only arc welder I keep in the shop and it works great for light- to medium-duty tasks. For anything complicated, I borrow a professional MIG welder from a friend.

Cleaning a Plated Item

When cleaning plated objects, be gentle, and don't use destructive tools such as a wire wheel. You can use standard tarnish remover from the grocery store, or just use baking soda or borax with boiling water.

Here's an example of a sheet-metal repair that could be covered with powder coat when finished. For this project, I started by tack-welding this patch in place of damaged metal.

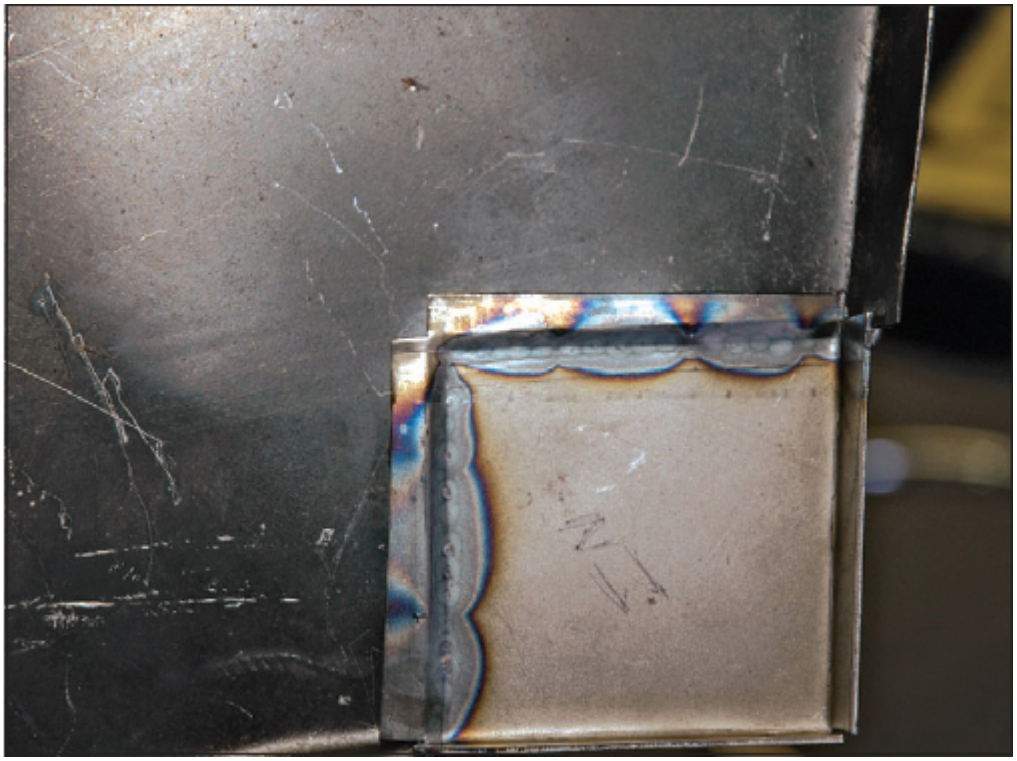
Once tacked into place, I ran weld beads over the joints of this patch.

If some of the chrome plating is flaking off, you have to take it all off. However, if the plating is in good shape, you can coat it.

Because these kinds of metals are generally used for valuable parts, this is another great use for clear powders. Just be careful to preserve the shine and the color of the underlying metal through the cleaning process to get great results.

Repairing Holes, Cracks and Divots Before Coating

Occasionally you want to powder coat a part that needs some metal repair before you begin. This is especially true for automotive restoration projects, and is likely to happen more often than you might expect because powder coat is an excellent way to hide previous metal repairs.



On the other side, you can see that there is excellent weld penetration through the metal. This is a good, solid weld.

After some work with the auto body grinder this weld is smooth and invisible. This part can now be powder coated and will look like new.

Getting the right supplies for your project is critical. You may have seen MacGyver on TV making a weld with a pair of jumper cables and a quarter, but that's really not a recommended technique. The good news is that you're not likely to need everything you see in a welding shop.

Welder Types

A 120-volt wire-feed welder (readily available at discount tool stores such as Harbor Freight) and some general-purpose solder/filler rod and a handheld propane torch gets you through almost all steel projects.

Working with aluminum is trickier, and requires MIG or TIG welding; this is best left to professionals if you don’t already have the equipment.

By the way, if you need to weld cast iron, a stick welder can be rented at most welding shops, and the correct welding rod is readily available.

Wire Types

If you plan to use a wire-feed welder on steel, you have two basic choices for welding wire: flux-core and solid metal. Flux-core wire includes its own welding flux, which is a material that burns and creates the air-free area in the vicinity of the weld. The flux also forms a crust over the surface of the weld that you need to chip or brush off as the weld cools. If you try to weld over the crust, some of it becomes trapped as a bubble in the weld, which reduces weld strength and looks ugly.

The benefit of flux-core wire is that you don’t have to deal with a bottle of gas. You just plug in your welder and start working. The downside is that flux-core wire requires AC operation and produces a lot of smoke and splatter. Flux-core is also not recommended for welding thin (20 gauge or less) materials.

With a small bottle of MIG gas (generally argon or a mixture of inert gases) you can work using DC power and get a much smoother weld, but then the whole assembly is more expensive. Common flux-core wire choices for automotive work include Lincoln NR-211 or any wire that meets the American Welding Society (AWS) E71T-GS standard.

Welder Power Level

For a basic flux-core wire-feed welder, select a power level appropriate to the thickness of the material. Your welder may have switches or a dial to control the power, but the adjustment process is the same: Start at a lower power than you think you need and run a few test beads. Check for adequate penetration by turning the piece over; when you can see discoloration from the weld on the backside of the metal, you're working most of the way through the metal.

Wire speed is a function of the amount of power you select. If your welder uses a pair of switches to control the welding power, you have four power settings from which to choose. In general, the more power you use, the faster the wire speed.

Set your welder to its lowest power setting and set your wire speed at about 30 percent of its capacity, then try a few practice welds. Adjust the wire speed until you get a smooth flow into the weld.

If the wire speed is too fast, the wire pushes the welding gun back, or the wire breaks off and leaves short lengths sticking out of the weld. If the wire speed is too slow, the arc skips and sputters and the weld is uneven.

Basic Welding Techniques

If you are using a wire-feed welder, you have two ways to run a bead: "push" the weld by driving the puddle of molten metal ahead of your flame or arc, or "pull" the weld by dragging the rod, flame, or gun with the puddle trailing behind. If your weld area becomes too hot while using the push technique, you can try pulling to help your torch run a little cooler.

Generally speaking, neither way is better than the other, but most welders develop a preference for one. You may find that access to the weld site dictates which technique to use, so it pays to be proficient at both styles.

If you're using a stick welder, you have to strike the arc with a motion similar to lighting a match. Once the arc is created, hold the

stick about 1/8 inch from the material and push the puddle in the same way as with a wire-feed welder.

Notice that the MIG welding gun is angled toward the arc with the bead trailing behind the gun. This is pushing the puddle of molten metal forward, and you can see where the puddle has frozen as the gun moves on.

Pulling a weld angles the gun backward where the puddle has been. A master welder still leaves that "stack of pennies" look to a good

welding bead.

Welding cast iron requires a particular composition of welding rod usually applied with a stick welder. These are inexpensive devices and can be rented from a welding shop. Be sure to bring in the project if possible so they can advise you on the correct rod to use.

With stick welding, the coating on the rod burns to keep oxygen out of the weld and protect the bead. This material forms a crust on the weld, which must be chipped, ground, or brushed away when the weld is complete.

You need to move your hand closer to the material as the welding stick is consumed. Don’t touch the material with the stick, or the arc stops. Similarly, don’t let the gap become too large, or the weld quality suffers and the arc eventually flames out.

When you have used up the rod or have finished welding, simply pull the rod away from the material to break the arc. ■

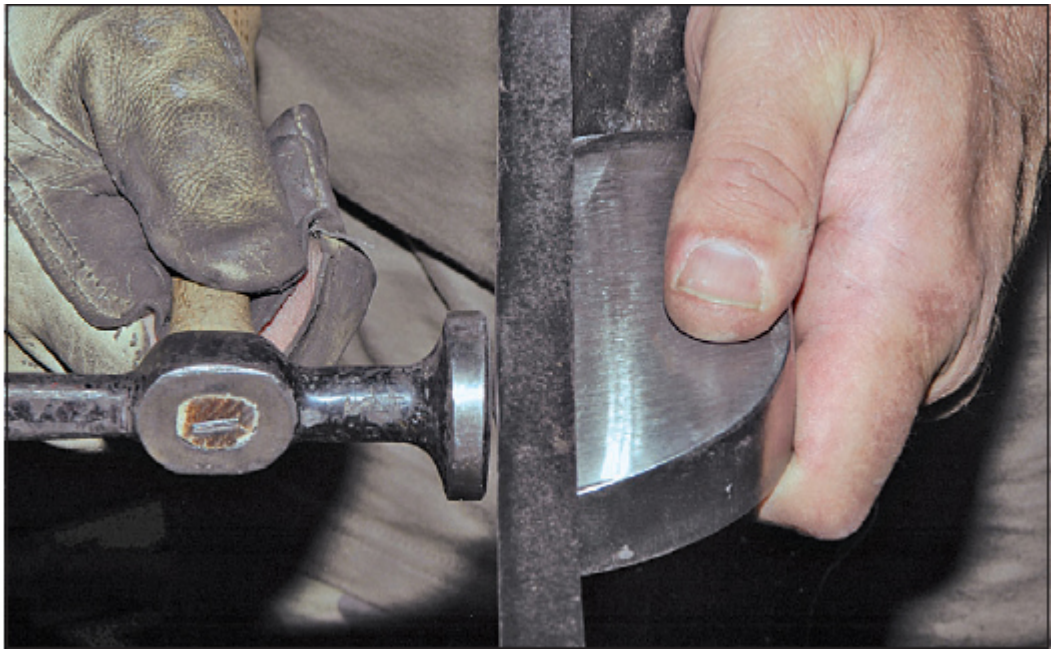
This is a perfect repair to this cast-iron part. It can now be ground smooth and coated. You can learn to weld well enough to repair your own projects with just a little practice.

Adjust the wire speed until you get a good, smooth arc and weld bead.

Filling Holes Using Rosette Welding

The most common welding repair you're likely to perform before powder coating a part is to weld up a hole that someone previously drilled in a part. Welders use a rosette (or "plug") weld to fill small holes, up to about 1/2 inch in diameter. You simply weld in a circular motion to deposit filler rod around the perimeter of the hole until it is closed up.

The name "rosette" describes the weld well; when you do it right, it looks a bit like a flower.



A good technique to learn is hammer welding; this is simply hammering down the welding bead while it is still hot and malleable. It reduces the amount of grinding required.

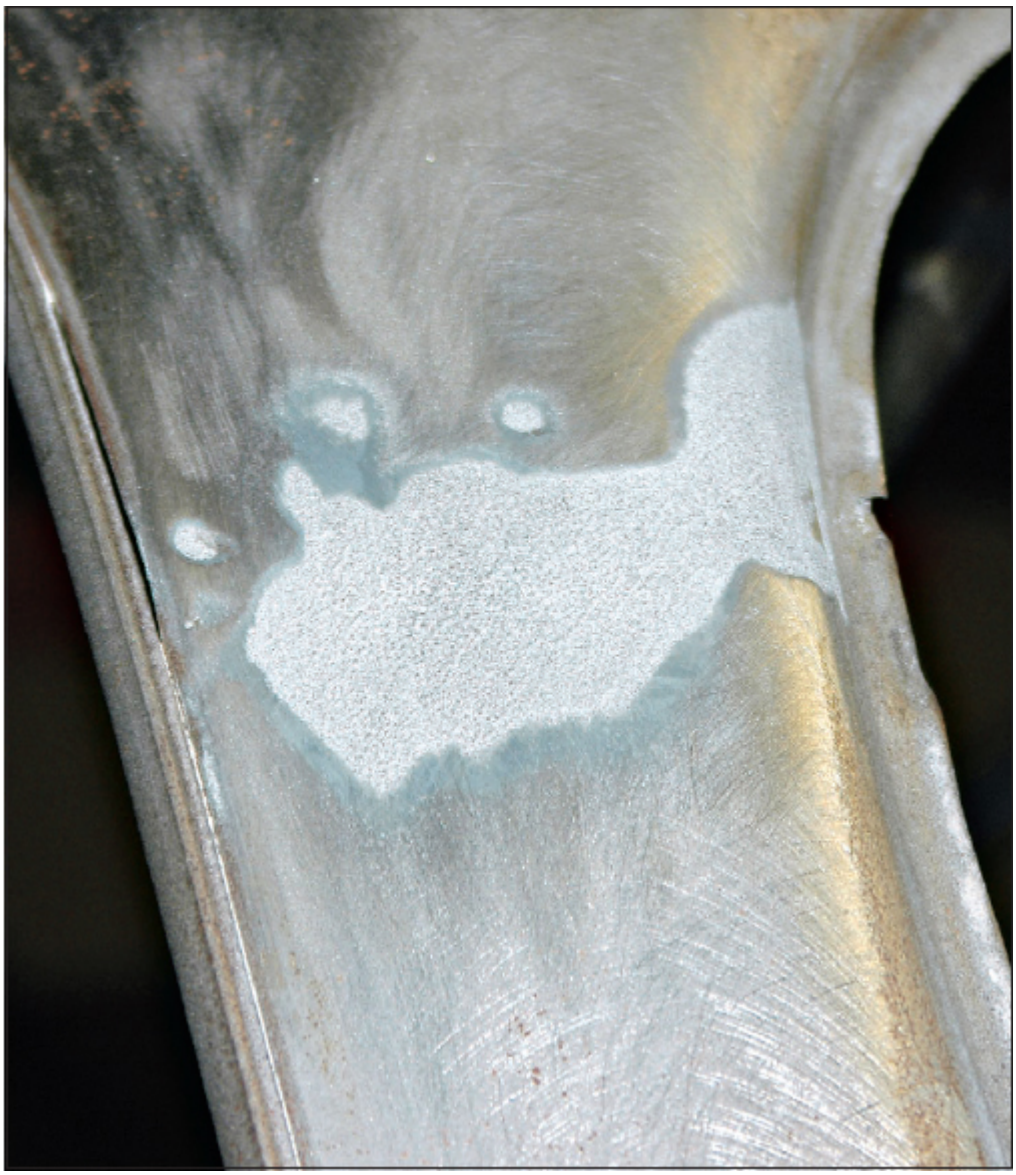
Smoothing Welds with a Hammer

Another technique that comes in handy when repairing parts before coating is hammer welding. With this technique, you simply hammer down the “scar” of a weld bead while the weld is still hot and the metal is malleable. Use a bodywork hammer and dolly for this, but remember that you will still likely have to file or grind the surface smooth. Be sure you don’t pound the part out of shape.

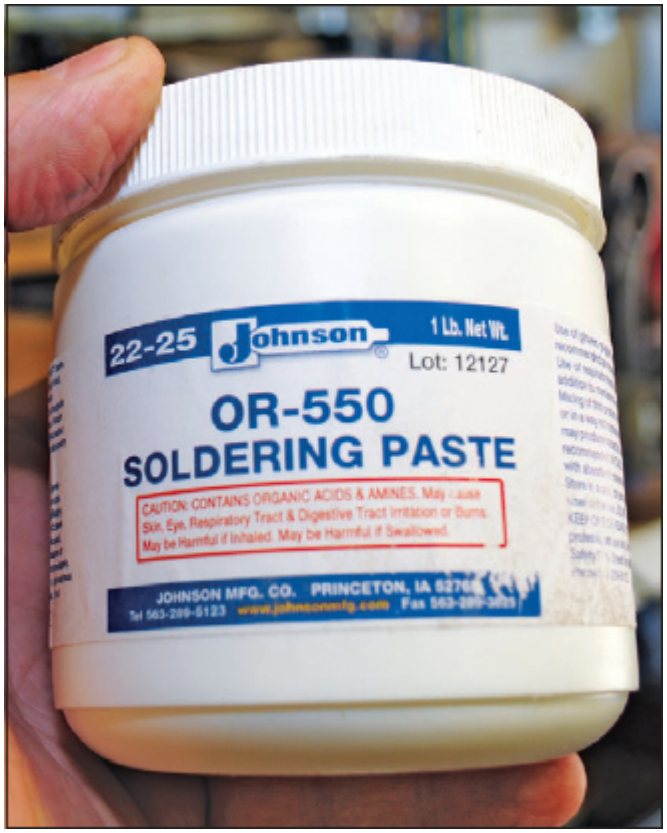
Filling and Smoothing with Solder

If you have a part with a divot or deep pits, or that simply needs to be smoothed over before coating, a really convenient method is to fill the area with solder. In the past, pure lead was the material of choice, but lead and lead fumes are toxic and should be avoided if possible. Eastwood makes a lead-free solder specifically designed for smoothing over divots. Its main use is for automotive bodywork, but it works well on smaller metal parts that you want to powder coat.

Although welding takes specialized tools, you can apply solder with little more than a plumber's torch. These cost just a few dollars at a hardware store and run on bottled propane fuel.



Solder can be used with steel, aluminum, or other metals and made smooth. Auto body specialists used lead solder for decades as a malleable and shapeable substance when smoothness was required.


22-25
Johnson
1 Lb. Net Wt.
Lot: 12127
OR-550
SOLDERING PASTE
CAUTION: CONTAINS ORGANIC ACIDS & AMINES. May cause
Skin, Eye, Respiratory Tract & Digestive Tract Irritation or Burns.
May be Harmful if Inhaled. May be Harmful if Swallowed.
JOHNSON MFG. CO. PRINCETON, IA

Solder paste is a flux that helps the tin alloy stick to the surrounding metal when you melt the solder in place. It's a good idea to use it every time.

Eastwood carries a great selection of solder supplies. You can use Lab-metal instead of Bondo-type products and still powder coat your parts.

Eastwood's solder melts with the heat of a handheld plumber's propane torch, but stays strong at the temperatures used to cure powder coat. The soldering rod starts to become malleable at 428 degrees F, and works best at 535 to 660 degrees F. Because all powders you will be using cure at lower temperatures, this solder is perfect for part repairs and smoothing. The solder is always softer than steel or aluminum, and you can smooth it over with a file or sandpaper.

Here, I'm heating and applying a stick of Eastwood's lead-free solder to an aluminum part. I've previously heated this part and applied some solder paste.

Here's the bead of solder. I need to file that down before coating this part.

Even though I soldered on the flat face of an anvil, the backside of the solder is raised from the surrounding metal. You can see the residue of the solder paste on the surface.

A hand file is the best tool for this job. The main part is aluminum, which means that it could easily be damaged by power tools.

This filing job isn't perfect, and more work remains to be done, but the solder is becoming flattened. When it's perfect, no one will even know the repair was made.

Be careful with grinders, however; they eat this stuff very quickly. In addition, safety is always paramount. Even if it's lead-free, always wear a respirator when working with solder.

You may have used a soldering iron on electrical components; this process is fundamentally the same: You melt a soft metal filler material (usually an alloy of lead, tin, and other metals) and use it to attach a wire or transistor/resistor/diode to a fixed point. The molten soldering metal flows and sticks to both parts and when it freezes, it has enough grip to hold the wire or component in place under reasonable stress.

The same principle applies to repairing metal parts: You melt the solder and it fills the gaps or pits in the metal, and it stays in place when the metal cools.

Here are the basic steps for using solder:

1 Make sure the part is completely clean.

2 Fire up your plumber's handheld torch (available at any hardware store) and hold the rod up to the area on the part that you wish to fill.

3 Heat the end of the rod until the solder melts and then spread the molten material around with a metal spatula until it covers the area.

4 Reheat as necessary while you work. The solder hardens quickly as it cools.

If you have a selection of files in different shapes, sizes, and style of teeth you always have the file you need.

5 Solder is not nearly as hard as steel or even aluminum, so once it is cool, you can smooth the solder to the level of the surrounding part with a hand file and then sand to a smooth surface suitable for powder coating.

6 Be sure to clean the part after you finish the repair.

CHAPTER 7

SUPPLIES, EQUIPMENT AND PREPARATION

Powder coating requires substantially more investment in equipment and preparation than simply painting a part, but the results are worth it. When you have set up your powder coating area and prepped your first pieces for coating, it's finally time to apply powder, place the piece into the curing oven, and realize some of those good results.

This chapter starts with reviews of the commonly available tools and supplies specific to powder coating; there really aren't that many on the market designed for the amateur. I have performed some detailed evaluations of commonly used available products so you can choose which application system, powder, and other supplies to purchase.

Purchasing a Powder Coating Kit

Many professional-grade powder coating kits on the market come from a variety of suppliers, but for home use you should consider The Eastwood Company kits and a less-expensive Chicago Electric option from Harbor Freight Tools. Caswell Plating also offers powder coating kits at a somewhat higher price.

Eastwood offers both low- and high-voltage guns for smaller and larger projects (respectively), or you can buy a kit with both guns. Eastwood kits

also include other useful items such as plugs and tape for bolt holes and caps for threaded studs to keep powder out of places where you don’t want it to go. They also carry supplies of powder in various colors as well as instruction/mixing books.

The Chicago Electric option is less expensive and not as complete. It includes only the gun and electronic current box, plus a couple of powder receptacles. The powder must be purchased separately. Harbor Freight powder options are limited to black, red, and yellow, but any powder may be used in any gun.

If you look at the professional systems available online, the sky’s the limit for price and functionality. The same places also sell large ovens, racks for shooting and curing parts, and powder recovery systems to collect the powder that doesn’t stick to the part.

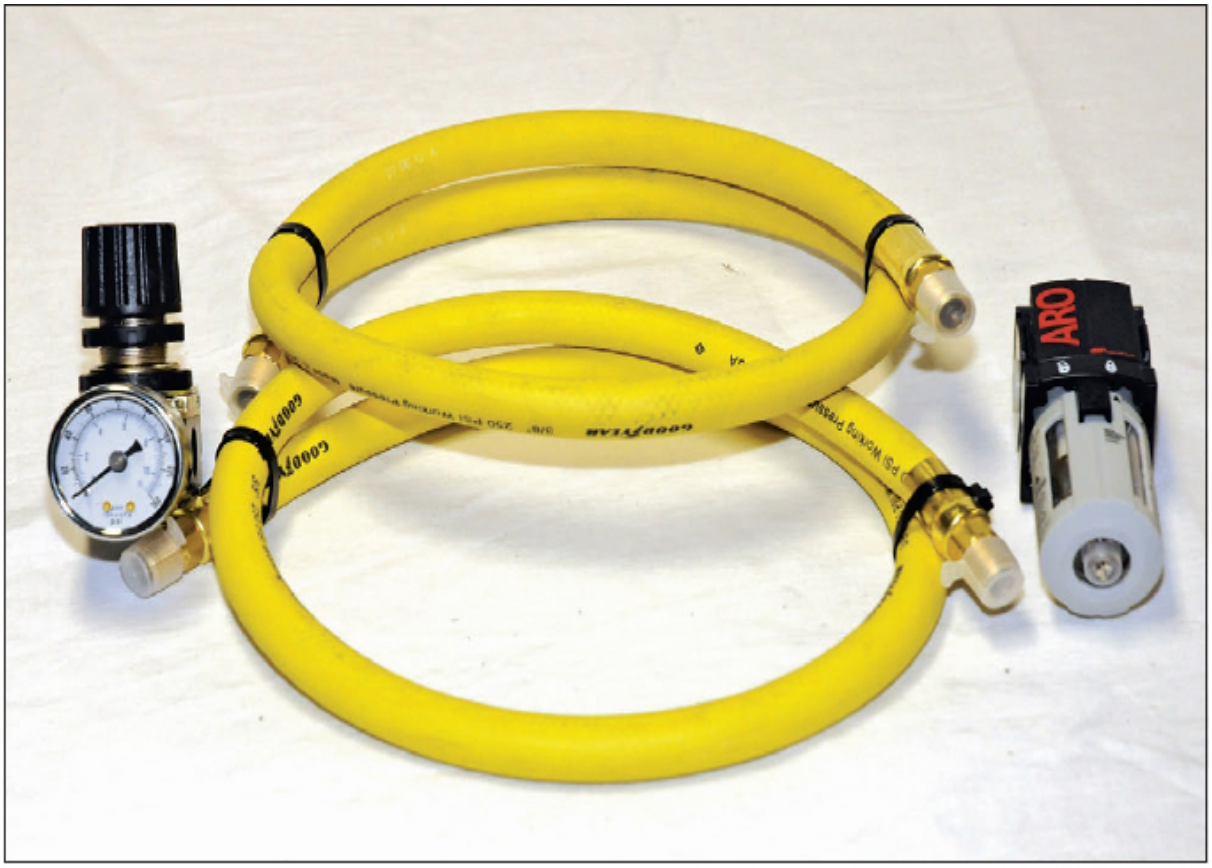
You can buy this Chicago Electric powder coating kit at Harbor Freight Tools. It's a good, serviceable kit at a good price but not as refined as other kits available on the market.

The Eastwood HotCoat kit is the gold standard for home powder coating. This kit doesn't cost much more than a discount kit, but it is much more refined and set up to use Eastwood powders.

In general, professional equipment is quite expensive compared to the budget of the home powder coater. If you're willing to spend the better part of $10,000 on an oven and the infrastructure to support it, then with practice, a professional-quality gun yields fully professional results. That's a key point because you can get perfectly acceptable results with the hobbyist-grade powder coating systems on the market for a small fraction of the professional price.

You can also find professional-grade guns and kits on craigslist and eBay from time to time; just use your common sense and try to avoid units that are worn out or broken. A good deal on a pro setup can become expensive very quickly if you have to replace several components. The usual warnings about used tools apply: Why is the seller getting rid of a perfectly good powder gun?

The Eastwood Dual-Voltage kit allows you to change the electrical power going to the gun for better coverage on difficult jobs. This kit costs a bit more, but is worth the expense if you need the higher voltage for bigger parts.



Get yourself a couple short lengths of air hose and a pressure regulator. A filter (at right) and a water separator are also good accessories to put on your air line.

For this book, I performed the projects using both varieties of the Eastwood gun and the Harbor Freight gun. Wherever possible, I used all guns with the same powder and curing process on the same material to compare results.

Many industrial paint stores also carry powder and powder guns, so if you want to examine the products personally before purchase, that's your best bet. Just remember to be fair. If you spend time with a salesman considering a product, don't turn around and buy it online just to save a couple of bucks.

Buying Extra Powder Coating Supplies

It's always a good idea to buy plenty of supplies in a variety of colors. You may end up needing the super-duper kit of high-temperature tape, plugs, and caps sooner than you think, and the initial supply of powder doesn't get you very far.

Plus, after you have some good experiences with your first powder coating projects, chances are good that you'll want a range of colors, plus clear coat, candy-apple, metallic finishes in gold and silver, and anything else you can find. You can even get glow-in-the-dark additives; the possibilities are truly endless.

Powder coating supply sites can provide as much as you want, and it doesn't cost much once you've made the investment in tools, so there's very little reason not to purchase a variety of colors and styles. Plus, you can buy one or two colors at a time and build up your palette as you can afford it.

During a project, you may find that the industrial paint supply store is the best bet for restocking a powder quickly, because they'll have it on the shelf. That's handy when you run out in the middle of a project and don't want to wait a week to complete it. ■

Evaluating Home Powder Coating Systems

The three most common home powder coating kits on the market today come from The Eastwood Company and Harbor Freight Tools. Eastwood is a leading provider of all sorts of tools and products for the automotive restoration and customization hobbyist or professional. Eastwood offers two slightly different versions of the popular HotCoat powder coating system. Harbor Freight is a leading discount tool supply company, and offers one Chicago Electric kit for powder coating.

One potential weakness appears in all three common home powdercoating kits: The clip for the grounding wire is a small, lightweight unit. This offers an advantage for the many cases when you want to coat the entire part and desire a small clip point that might not get enough powder

for full coverage. You need only enough connection for electricity to flow, and often you can get good results by simply setting the part on the clip. But the clips have a tendency to slip off, and without electrical current powder adhesion is limited. To avoid the situation, it's a simple matter to remove the stock clip and crimp on a more substantial clip.

A critically important part of any powder coating kit is the grounding wire. The powder does not stick without the ground wire. Yet it is easy to forget to attach the wire. You can attach the wire to any metal in contact with your part. This works especially well with a dual-voltage gun at the high-voltage setting.

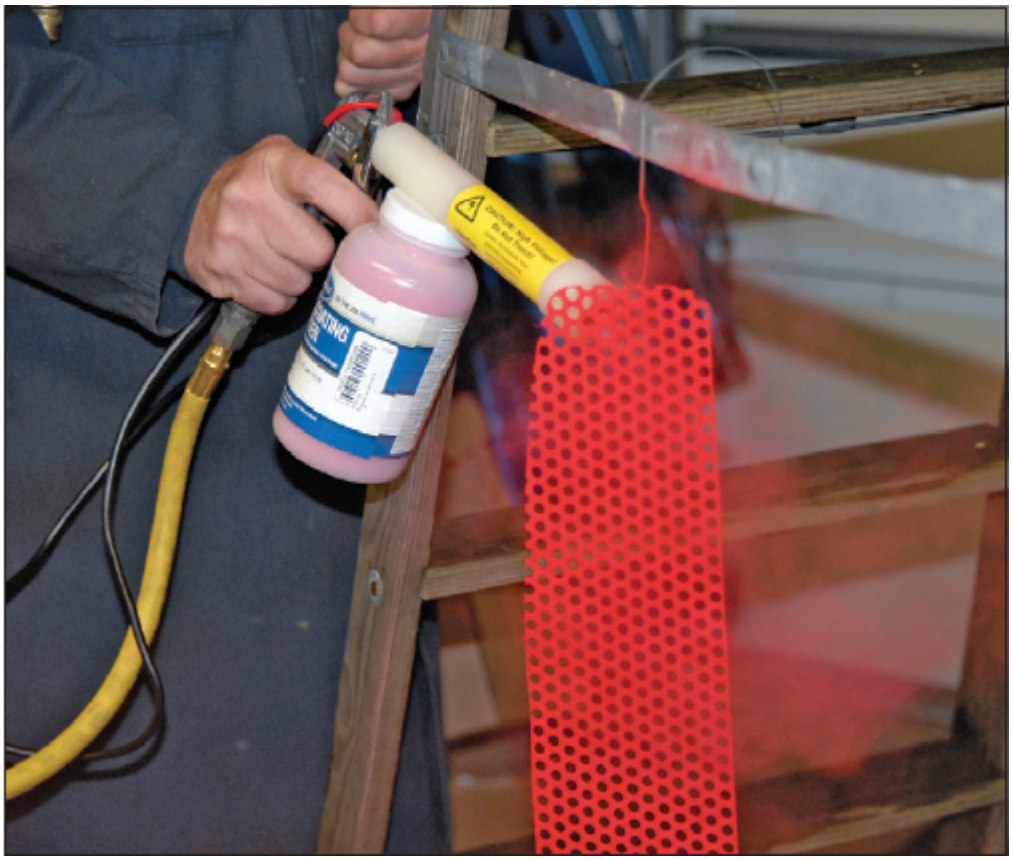
Eastwood Original HotCoat Powder Coating System

Eastwood's first HotCoat system powder coating gun is still the gold standard for home powder coating. The Original kit retails for about $100 at Eastwood.com, and includes the gun and one empty cup, the transformer with an activation switch that you carry in your hand, plus a handy color chip chart of Eastwood powder colors.

The gun delivers 11,000 volts at 15 microamperes, and works best at about 10 psi of air pressure. Some online reviewers have complained of leaks around the cup threads sending powder everywhere, but this is almost certainly due to excessive air pressure or cross threading the powder cup.

The system is just too simple to have this problem on a widespread basis. Many hobbyists try to adjust tool air pressures at the compressor, and that doesn't work. The pressure gauge on your compressor is not sensitive enough, and the delivered pressure varies based on the compressor's duty cycle.

The Original HotCoat gun works very well; you can adjust the spray pattern by moving the diffuser cone forward or backward on the electrode. You must be careful that you are not actuating the thumb button as you do so because there's no separate on/off switch on the transformer box. The gun delivers a good layer of powder on the part and is light and maneuverable.



This original HotCoat gun from Eastwood is spraying a custom-made grille for a Mazda Miata. With the regulator air hose attached, you squeeze the thumb switch for current and the powder goes on without a lot of waste.

To send current through the Eastwood gun, onto the part, and back on the ground wire, you have to press this switch. The Harbor Freight kit uses a foot pedal for this function.

To use the Original HotCoat gun, simply connect the air supply, plug in the transformer, squeeze the thumb-button activator, and spray.

You need to purchase the air fittings and moisture separator separately, as these are not included in the kit.

Eastwood's Original HotCoat gets points for convenience. The cups in which Eastwood delivers its powders are the same as the empty cup in the kit and the spare cups that you can purchase. This makes using Eastwood powders a snap; just screw in the storage cup of the powder you want. Eastwood sells 8 ounces of the powders in 16-ounce cups, which is perfect because the cup is not overfilled when you start to use it.

To change colors, disconnect the gun from the air source and connect a blower to the air. Unscrew the old color cup, knocking as much powder as possible off the pickup tube, and then blow off the tool.

Bottom Line? The Original HotCoat system is the best value for professional-grade results. You can buy just the tool and it will handle all reasonable powder coating needs. The best deal is to get a full starter kit with several empty cups, a supply of common powders, a moisture trap, some plugs, tape, and safety wire.

Eastwood Dual-Voltage Powder Coating System

Eastwood also offers the Dual-Voltage Powder Coating System. This gun is similar to the Original gun, but includes a switch on the transformer that allows you to select an operating voltage of 15,000 or 25,000. The 15,000-volt setting is ideal for regular surface coating, and the 25,000-volt setting is optimized for harder-to-reach places. The increased voltage increases the attraction to the powder particles on the part. The Dual-Voltage Powder Coating System retails for about $170.

The kit includes the gun, transformer, and all cabling, plus one empty powder cup. As with the Original HotCoat, the smart buyer purchases the gun with a kit that also offers a supply of powders, plus high-temperature masking tape, silicone plugs, and safety wire.

Using the dual-voltage gun is substantially the same as using the Original HotCoat gun. You get excellent coverage and dispersion, and the diffuser is adjustable for different patterns. The Eastwood design is convenient and allows you to stand the gun on the cup when you’re not actively using it.

On the front of the transformer box for the Eastwood dual-voltage gun, you can see the red rocker switch. This switch selects high- or low-voltage mode.

When using a dual-voltage gun from Eastwood, you use the identical technique as with an original HotCoat gun. The only difference is in the electrical charge used to stick the powder to the part. You can leave the

system on low voltage unless you're working on a part with a complex shape, in which case high voltage helps the powder adhere to uneven surfaces.

A Harbor Freight gun (shown) differs from Eastwood guns. This gun requires the powder cup to go on upside down on top of the gun, rather than screwing in from underneath.

Having both Eastwood guns available makes it a simple matter to have two colors on hand; just switch the air supply hose to switch colors. Or you can have one color and clear-coat for multi-coat work.

I found no downside to using this gun in high-voltage mode, so I tend to leave it in that mode at all times. Again, online reviews suggest that some users have trouble with the system leaking, but these guns are designed to operate with just 5 to 10 psi, so bringing too much air pressure to the gun likely caused the leaking troubles. With both this kit and the Original HotCoat, used at the prescribed air pressures, I had no leak failures.

Bottom Line? The Eastwood Dual-Voltage Powder Coating System costs quite a bit more than the Original HotCoat system. If you plan to do

complicated work on irregular surfaces, or if you plan to do a great deal of coating, this kit is worth the investment. Once again, purchasing a full starter kit is well worth the money, as you will need the selection of powders and the tape, plugs, and other supplies immediately.

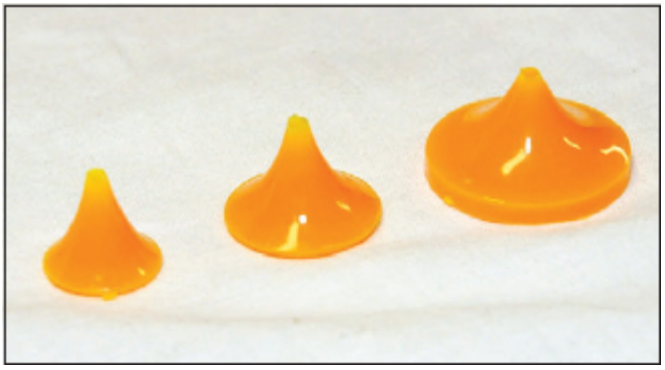
Chicago Electric Powder Coating System

Chicago Electric's kit, available at Harbor Freight Tools, costs about $65, but is often on sale for less. The kit includes the gun assembly with transformer, foot switch for power activation, the gun itself, a disposable moisture separator, three empty plastic cups for powder, and a small spares kit with extra diffuser tips, O-rings, and a spare fuse.

This kit appears rudimentary compared to kits from Eastwood, but generally does a good job. Online user reviews suggest that quality may vary from box to box (or aptitude may vary from buyer to buyer). Critical reviews state that the seals often fail and blow powder out of the cup, but that seems likely to be caused by setting the pressure too high for the gun. Setting pressure at about 15 psi yields good results. Still, keep your receipt and try the product immediately to confirm that you have a good unit. If the unit leaks or is otherwise less than expected, Harbor Freight is good about making exchanges.

Be sure to pick up air fittings in your shop's standard configuration, as these are not included.

Upsides to the Chicago Electric kit include the variety of diffuser tips that come with the kit. These allow you to get a nicely narrow and precise powder stream, or a broad dusting effect. One demerit for the Chicago Electric gun is that the cup attaches from the top, upside down at an angle, which makes changing the cup somewhat clumsier than with other kits. The gun and cup are also larger and heavier than competing models.



One nice thing about the Harbor Freight gun kit is that it comes with a variety of diffuser discs in various sizes. This allows you to better control

the powder spray pattern.

The foot switch that activates the gun's electrical charge is a mixed bag. On one hand, the foot switch is more convenient than a hand-activated switch, but only if you can reach all areas of the part without walking around it. If you need to circle the part, you have to kick the foot switch around with you, or put something on it to keep it actuated, and risk a nasty shock!

As powder runs low in the cup, you have to give this gun a good shake to restore the flow, but coverage is good and the electrostatic effect works well. The on/off switch on the transformer is a nice touch. Flipping the switch allows you to be certain that the unit is off before you set down the gun. Chicago Electric does not publish the operating voltage for this kit.

Bottom Line? This is a good starter powder coating system, and you can get good results for not much money. The Chicago Electric kit accepts any brand of powder, and that's important because all powders are not created equal. Harbor Freight powders did not deliver the desired color, and required more powder to achieve coverage. Your least expensive option for good results is to buy the Chicago Electric gun and then buy Eastwood supplies or quality powders from another source.

Purchasing Powder and Supplies

When you buy a powder coating gun and transformer kit, you should also be thinking about additional supplies. These include powders, a respirator, and a stash of plugs and high-temperature tape to mask off your projects.

Virtually all powder guns dispense any brand of powder, and there are hundreds of options on the market today. Many powders are expensive but offer fantastic effects, such as metallic, veined, crinkle, anodized, and candy-apple finishes. At the other end of the spectrum are low-cost powders that may or may not work well.

In addition to powders, the list of other consumables you need is mercifully short, especially after the long list of infrastructure items and cleaning supplies you already bought! The list of consumables is generally limited to silicone plugs, plastic covers, safety wire, and high-temperature

tape. You can get all of them from Eastwood. I have not found them anywhere else.

High-temperature masking tape was used on one of the stainless mixing bowl projects to keep powder off the edge. Careful wiping could accomplish the same effect.

Silicone plugs and covers are pretty self-explanatory. You don’t want a thick layer of hardened powder coating in threaded holes or on studs, so you plug or cover them before you apply the powder. They keep the powder out and survive the oven. You can remove and reuse them after the parts have cooled.

Follow Powder Coating Instructions

Every powder has its own prescription for curing temperature and time. It is critical to achieving the best results. For each powder you use, follow the recommended flow and cure temperature, times, and instructions. Leaving the part in the oven too long can be as bad as taking it out too soon.

Eastwood powders cost somewhat more than others, but they are worth it for the excellent coverage and depth of color they offer.

Here are four finished stainless steel mixing bowl projects using various powders. The green and blue ones are Eastwood powders and the pink and orange ones were purchased on eBay. In every case, good coverage and great color are achieved with basic skills.

Use the safety wire to hang your parts. It's nice because you can pull out any length and bend it with your fingers much easier for on-the-fly work than using heavier coat hanger wire.

High-temperature tape may seem like an extravagance, but it's not. You need it because the glue in common masking tape bakes onto the part and is really difficult to remove. The high-temperature tape is not super-sticky for this reason, but it holds well enough to get the powder onto the part and then get the part into the oven. Once the powder has cured and the part is cool again, you can easily peel this tape off with no residue.

Evaluating Powder Sources

In the course of research for this book, I tested powders from several different manufacturers under reasonably controlled circumstances and

made the following evaluations:

Eastwood

Eastwood powder is uniformly high quality and is offered in a broad range of colors and textures. Eastwood sells its powders in 8-ounce (1/2-pound) cups, or 2-, 5-, 10-, 25-, and 50-pound containers. Buying colors in the 8-ounce cups helps hold down the incremental cost for adding colors to your palette. When you find a color you like, you can buy the larger size. Prices vary based on the composition of the powder, but basic colors are about $20 to $35 per pound in the 8-ounce size, and about $10 per pound in the 5-pound size, and even lower in larger sizes.

Another smart way to try many Eastwood colors is to buy a powder kit. Standard, metallic, and high-tech packages of 6 or 16 colors are available for less than $10 per color.

Many of Eastwood's exotic powder colors, such as chrome, work best with a second coat of clear gloss to protect the color from the elements. The clear gloss powder costs about the same as other powders, so be sure to take that expense into account for your budget.

Bottom Line? Eastwood powders are the best choice for the home powder coater. Quality is high, and you don't have to buy in professional quantities to get a good selection of colors.

Harbor Freight

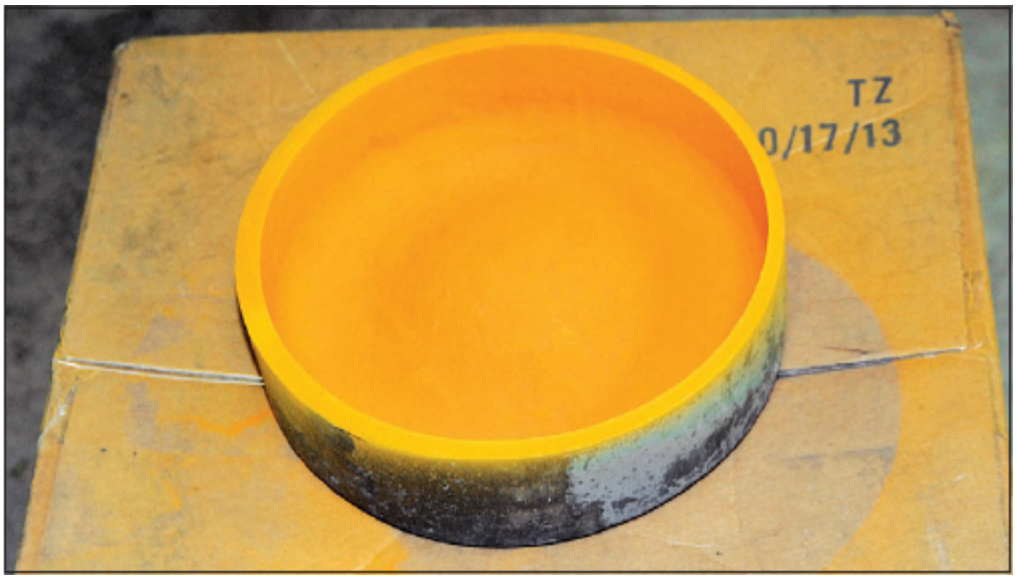
Harbor Freight powder has the advantage of being inexpensive. You can get a pound of powder in a plastic cup suitable for direct use on the Chicago Electric powder coating gun for about $5.50. That's a fraction of the cost of other powders, but the tradeoff is that the tone and coverage of these powders is somewhat uneven. You often get a more translucent effect than the rich, solid color of other powders. Harbor Freight powder is available in red, yellow, white, and black.

This may sound like a bad evaluation for this product, but remember this: You can get one pound each of all of the four colors offered by Harbor Freight for less than the price of a single pound of many other powders. So it makes a lot of sense to get some of this product and try it out on some test projects. When you know what results you're going to get, you can decide when to use this powder instead of more expensive powders.

The upside of Harbor Freight powder is that it appears to be just as tough and durable as more expensive powders. This makes it an excellent choice for parts that are not seen, or that are subject to a great deal of mess, abrasion, and general abuse.

Harbor Freight powders cost a lot less than others but lack the coverage and the depth and strength of color that others offer. It's good to keep some around for parts where color matching is not critical and low-cost coating is desired.

The Chicago Electric powder coating gun from Harbor Freight works well and can be used with any brand of powder.



A thick coat of Harbor Freight powder has been applied to the test part. This is also the first stage of a two-tone project. When performing two-tone projects, always use two curing stages. Most powders on the market are thermosetting types, which means that they do not melt twice. You can cure one color and then the other. Always cure the powder with the hottest cure temperature first.

You can see that this powder did not cover with a depth and strength of color common to other powders. A double coat was required to get a good, solid color.

Bottom Line? Get some Harbor Freight powder. It's inexpensive and you can use it in any gun by transferring the powder to a cup that fits onto the gun you have. Use it when appearance is not a factor.

Other Sources

You can find many powder providers online, and you may be able to purchase their products from a local powder coating business as well. In particular, eBay has a good selection of powders in multi-color lots. Be sure the ad specifies new powder, rather than reclaimed powder, however.

Powders purchased in bulk do not come in a convenient cup, so buy several extra cups (as many as 20 if you intend to use a lot of different colors) for the gun you own. Bulk powders generally come in quart or gallon zip-lock bags, or double bagged in open-top plastic bags that are tied shut. Use a clean plastic funnel to transfer powders from plastic bags into your own powder gun cups.

These powders were bought online, and include red wrinkle, cobalt blue, transparent gold, and neon pink.

Translucent gold works well on a stainless steel mixing bowl, giving the entire bowl the look of gold and a highly reflective shine.

The quality of powders from eBay suppliers is a little uneven; some work better than others. I tested many through various guns without incident and they cured to a good finish, especially basic colors in flat or gloss. One batch of red crinkle finish did not crinkle as much or as nicely as the Eastwood crinkle black, but more experimentation with varying cure time and temperature may yield a better result with this powder.

A transparent gold-tone powder from allpowderpaints.com called 24 Karat yielded a nice golden effect on a stainless steel bowl. The powder cures to a medium gold finish that is mirror-bright and even.

Bottom Line? Powders you buy online are generally good, but prices vary widely and quality is not guaranteed. Your best bet is to test any powder you buy before you put it on a part you really care about. Just make sure you get new powder, and verify its cure temperature.

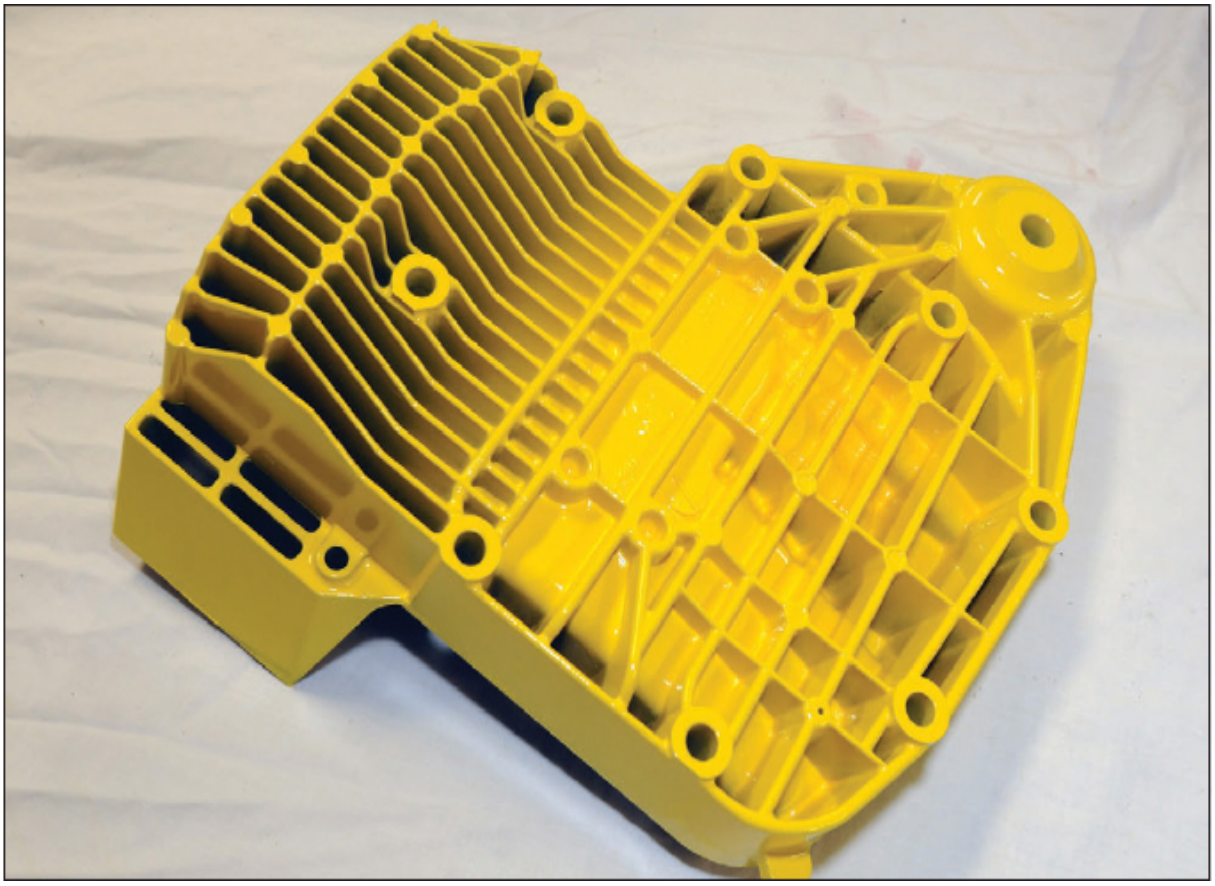
CHAPTER 8

POWDER COATING PROCEDURE

You've performed the preparation work, the wiring, the endless parts cleaning, and the setup in your powder booth. Now you're finally ready to apply powder! The truth of the matter: This is by far the easiest part of the process and the most fun. If you make a mistake or smudge the part, you can re-spray it so you're just out a little bit of powder.

Powder coating is an art. You will learn to recognize when there's a thick enough coating of powder on the part and how to deposit powder where you want it to go. This chapter is heavy on tips and advice, but there's no substitute for learning to adjust your own gun and using it to achieve the best results.

I cover the process of positioning the parts and applying the powder, followed by handling instructions appropriate to the ovens and curing methods available to the home powder coater. Examples are provided for several different kinds of projects. These include some key examples of what *not* to do, what happens when you break the rules, and some of the unexpected things that can happen. Sometimes the unexpected thing that happens is unique and useful; other times, it's just a mess.



Powder coat makes parts such as this differential cover look great, while not limiting the parts' function in any way. Powder is tougher than paint, and just as easy to apply once you learn the technique.

The basic message is simple: Powder coating is easy, so have fun and be creative, and don't be afraid to blow it all off the part and start over. Powder is relatively expensive, but not so expensive that you have to live with a mistake that you discover before baking your coating. Even after the coating is cured, it's a simple matter of using some gel stripper and you can still start over again.

Masking and Plugging Parts

If you have some silicone plugs and the special high-temperature masking tape, you're ready to mask and plug your part, if necessary. Basic items, such as steel bowls, wind chimes, wheels, and so on, often do not need masking or plugging. But you must protect any surface that you want

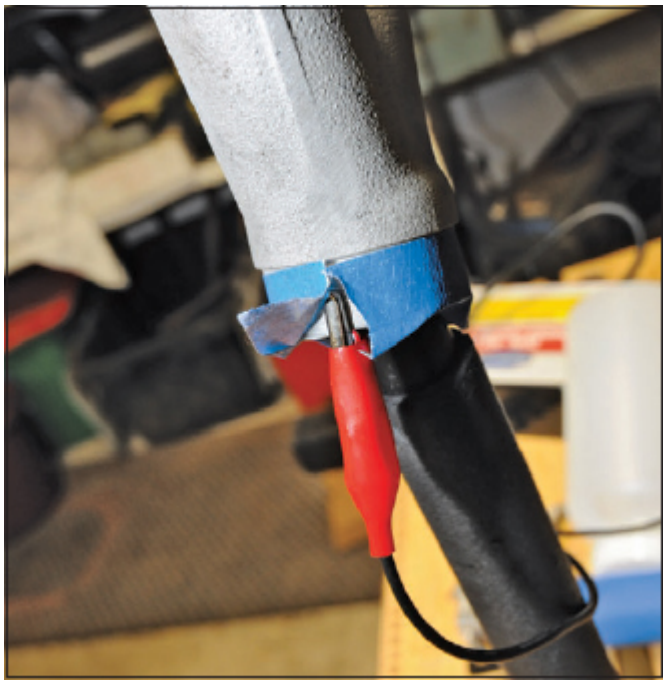
to remain uncoated, and that includes the mating surface of an intake manifold and any threaded fitting. Powder coat goes on thick enough to make a threaded hole unusable without running a chase tap through the threads.

Powder Coating Practice

Set your important first projects aside for a day, and spend some time coating pieces of scrap metal. Put the powder on too heavy, too light, inconsistently, and try to fix a few smudges. In short, give yourself a little practical experience before you tackle the real thing.

Plugging Holes

If you don’t have a set of silicone plugs, just run a bolt a few turns into the hole, but remember to take the bolt out before you put your part into the curing oven or the powder may glue it into place. If you run out of silicone plugs, simply roll a little cone of masking tape and use it as a plug. If you use high-temperature tape you can leave it in place during curing.



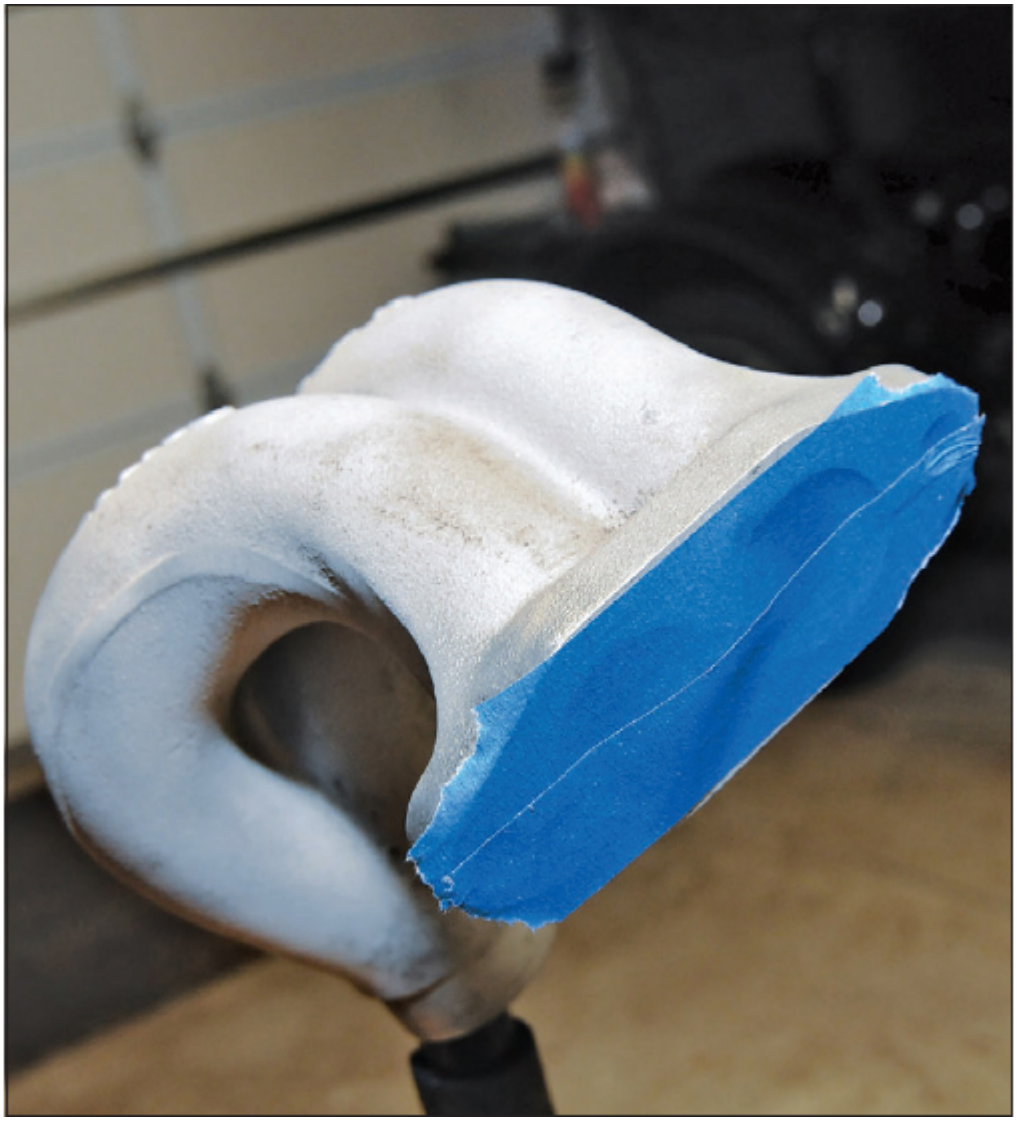
The area of this VW intake manifold protected by masking tape is perfect for attaching the ground wire. This is ordinary masking tape, so it must be removed before putting this project in the curing oven.

In another test of the Harbor Freight powder, I used a toaster oven to cure the part. I used some of the silicone plugs in the nail holes of an old horseshoe to raise the project off the pie tin I used as a base.

Silicone plugs come in a variety of sizes, and they are well suited to keeping powder out of threaded fittings and other areas.

If you run out of silicone plugs, just roll up some masking tape into a cone and stick it in the holes. You can remove it before curing, but because the glue is only sticking to the tape itself, you could leave it in place during curing.

You can get creative when setting up projects for coating. For example, I put this VW intake manifold on an old broomstick held upright by clamping it in a Workmate table. It was at just the right height and I had easy access to the whole part.



I carefully masked the mating surface of this manifold to keep powder off. That's painter's masking tape, so I will remove it before curing.

After coating, I removed the masking tape, and you can see that it kept the powder off the mating face of the part. This is easy to do. Just take your time and be careful.

Here's what happens if you don't remove ordinary masking tape. The glue bakes on and turns rock hard. It has to be removed with a wire wheel on the bench grinder.

Tape Removal

If you're having trouble getting tape off cleanly, just stick it to the pads of your fingers a few times to reduce the stickiness. It comes right off between the powdering and the curing steps.

The lip of one of the mixing bowls is completely protected with high-temperature masking tape. This can go in the oven, and it still comes right off.

To use this tape to keep the lip clean, I put it all around the edge, and then turn the bowl over on the box "table" for coating.

You can certainly use regular masking tape if you don't have the special high-temperature tape, but here again you must apply the tape before you coat the item, and then remove it before you cure the powder.

You must remove ordinary masking tape before curing because the glue on the masking tape becomes rock-hard and adheres to the metal. You have to use a wire wheel to get it off, and if you did a precise job, you risk scuffing your new powder coat finish. You want to handle the part as little as possible between the coating step and the curing step. If you have to remove a bunch of complicated tape next to areas you want to coat, your chances of smudging the powder are nearly 100 percent.

On the other hand, the expensive high-temperature masking tape can go right into the oven, along with the silicone plugs. Then, when the powder is cured and the part has cooled off a bit, the tape comes right off and the silicone plugs pop right out and are ready to be used again.

One simple method to avoid smudging the powder is to place the part on a sacrificial cookie sheet, oven rack, or piece of sheet metal with the side to be left uncoated facing down. Then you can coat it and take it straight to the oven without touching it at all.

Another way to avoid smudging the powder is to apply tape to a part, then use a hobby knife or razor to cut out areas you want to cover with powder. If you use the high-temperature tape, you can coat and cure normally and then remove the tape.

If I were smarter, I'd have put the baking rack under the part before I coated it! But it's easy to lift one edge, slide the rack under the project, and then transfer the whole thing to the oven.

For complex work with normal masking tape, try using your infrared curing system or just some shop lights to melt the powder so that it flows a bit, and then remove the masking tape before finishing the cure in the oven.

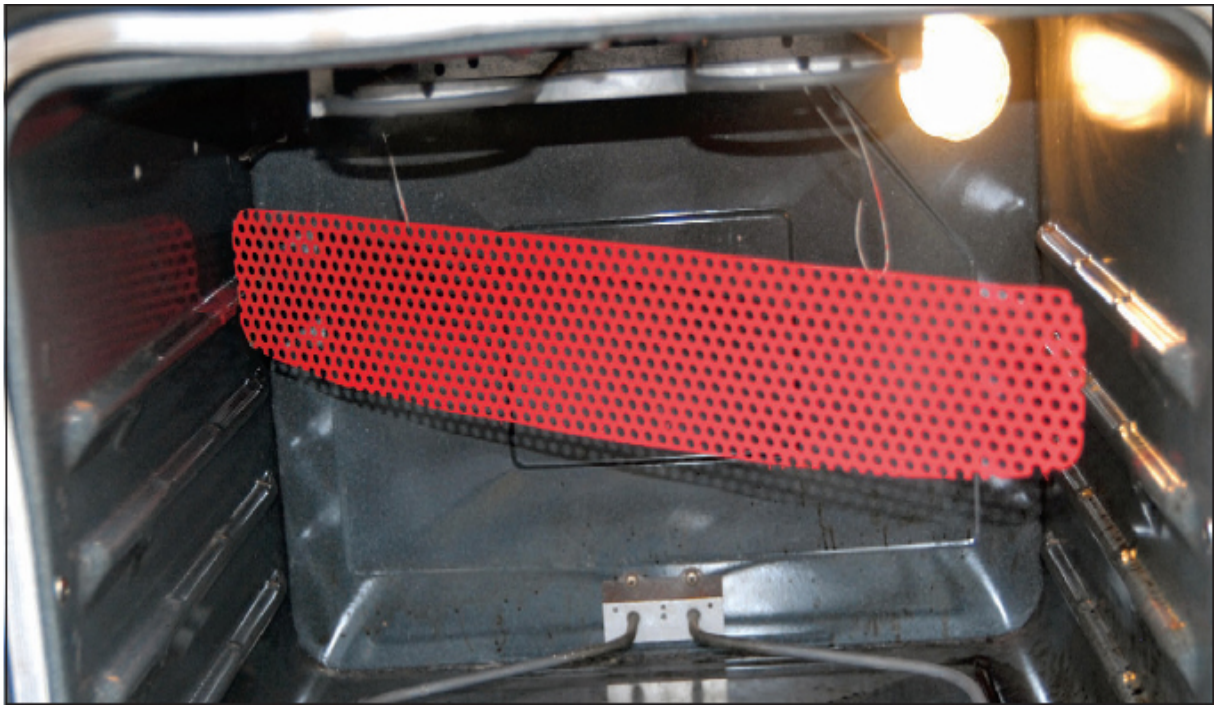
Be sure to have the proper supplies before you start a project. Wax paper, baking parchment, and aluminum foil are excellent supplies to have in your powder coating workshop. When you need to cover large areas with something that is oven-tolerant, it's better to use foil than a lot of tape.

Hanging Parts for Better Coating

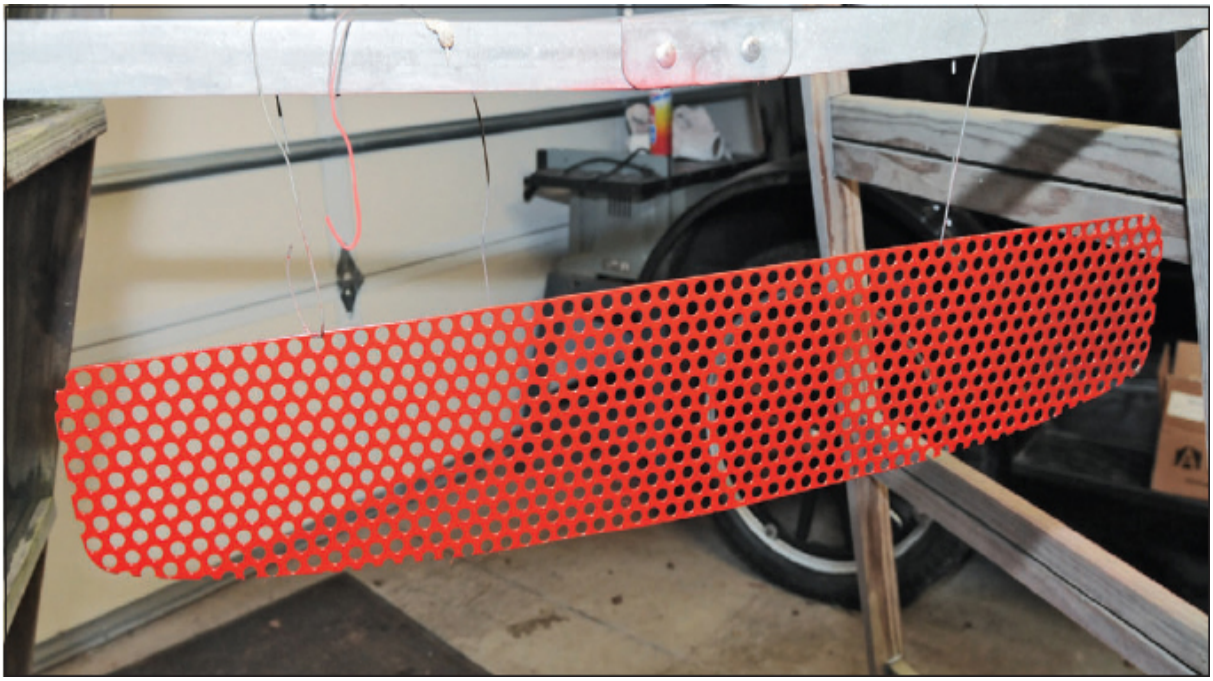
If your project needs powder on all sides, you need to hang it from something to get all around it with the powder gun. You can buy expensive racks for this, but you can get great results with an ordinary folding ladder. You can buy premade S-hooks or make your own out of old wire coat hangers or wire fence clips. Prehang some S-hooks from the broiler element in your curing oven. It is far easier to hang a part from preplaced hooks in a preheated oven; you avoid burning your hands and smudging the powder.

An ordinary stepladder makes a great rack for coating and cooling your powder coating projects if you don't have a dedicated coating rack. Metal rack shelving also works well.

I sprayed this part while it hung from the support bar of a stepladder. Because the bar is metal and the safety wire used to hang the part is steel, you can connect the grounding clip to anything metal in the assembly and the electrostatic effect works.



The Miata grille is out of the curing oven and looking good hanging under the ladder to cool. The powder got into each little hole on the grille, and looks great front and back.



The same part is hanging in the curing oven using steel safety wire twisted around the broiler element and its supporting structure. I took out all the oven racks to make room.

This will be on the front end of the Miata, so I wanted the coating to look great and last a long time. This is Eastwood gloss red powder.

Handling Coated Parts

Getting the part from your coating location to the curing oven is probably the most dangerous part of the process in terms of smudging the coating. You cannot touch any surface coated with powder, nor can you allow anything to brush up against the coated surface.

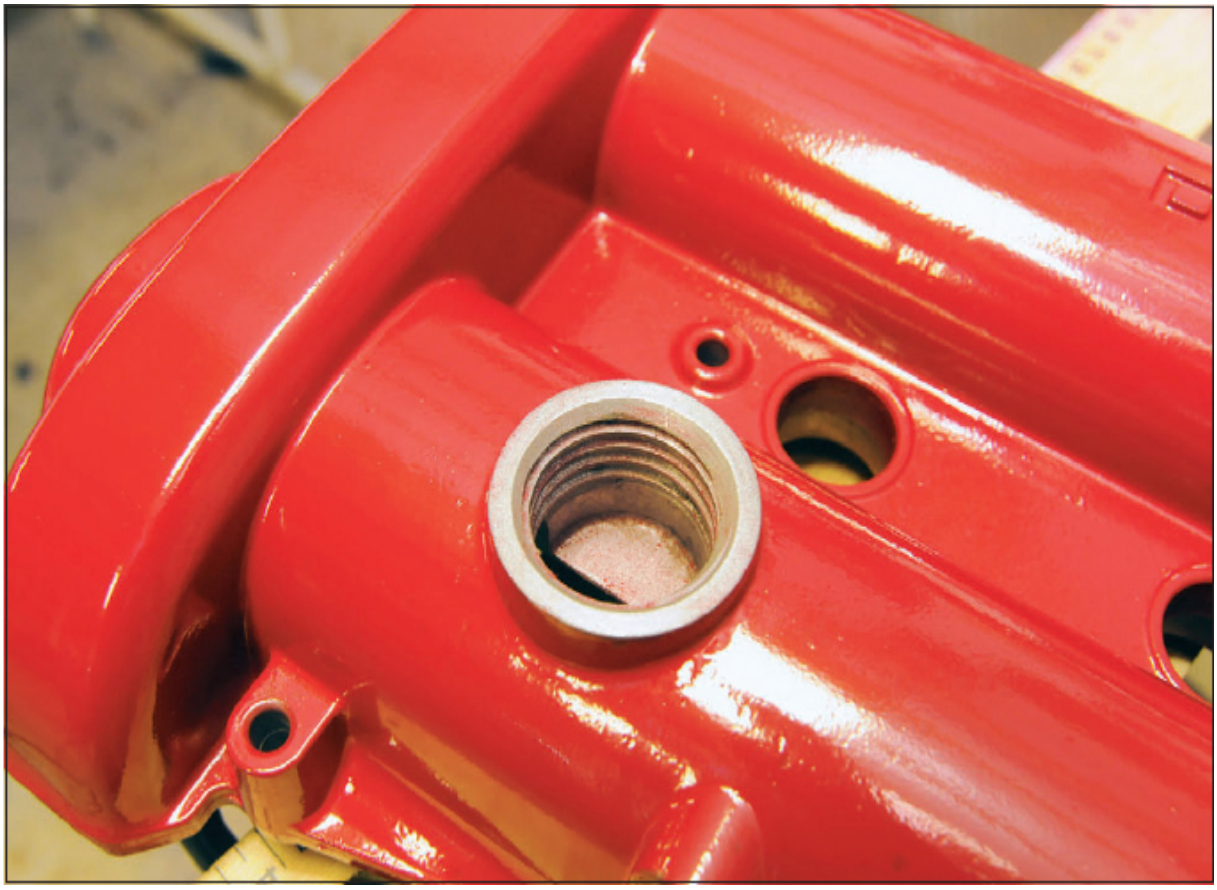
Some parts are easy to handle. If you coated a part that is on a baking sheet or in a foil pan, you can simply pick up the sheet or pan and slide it into the oven. If this is the case, you should preheat the oven to the curing temperature, slide the part in like a batch of cookies, set a timer to the cure time, close the oven door, and wait for the beep.

Other parts are easy to handle because you only coated one side; you can get a good grip on the part. For this reason, automotive wheels are usually easy, even though they are large.

Because work gloves don't provide enough insulation, a pair of oven mitts is handy to prevent burns. They are sure to get powder all over them, so do not use your good set of kitchen mitts!

Protect Your Parts Before Curing

Earlier in this book I advised you to locate your curing oven outdoors if possible. This is good advice, but you have to be careful of the weather. One day a stiff breeze blew up as I took a part outside to the oven and blew a big bald spot in the uncured powder! Another time, it started sprinkling rain in the ten feet from the door to the oven; the rain left pockmarks in the powder.



This Miata cam cover also turned out great. This is Eastwood gloss red powder, and this project will really dress up an engine bay and look great for decades.

Far more often, you face the intractable problem of having coated the entire surface of a part that now has to be moved into an oven where it

barely fits. The challenge is to get it hooked to the broiler element and suspended, or supported from below, somehow, without smudging the powder.

First, test-fit your part in the oven before you coat it, so you have a plan for getting it in there. Then create hangers and supports as needed. Take your time and be careful getting the part into the oven. Do not preheat the oven; this way you can use your bare hands. The part cures just fine from a cold oven. It just takes a bit longer to come up to temperature.

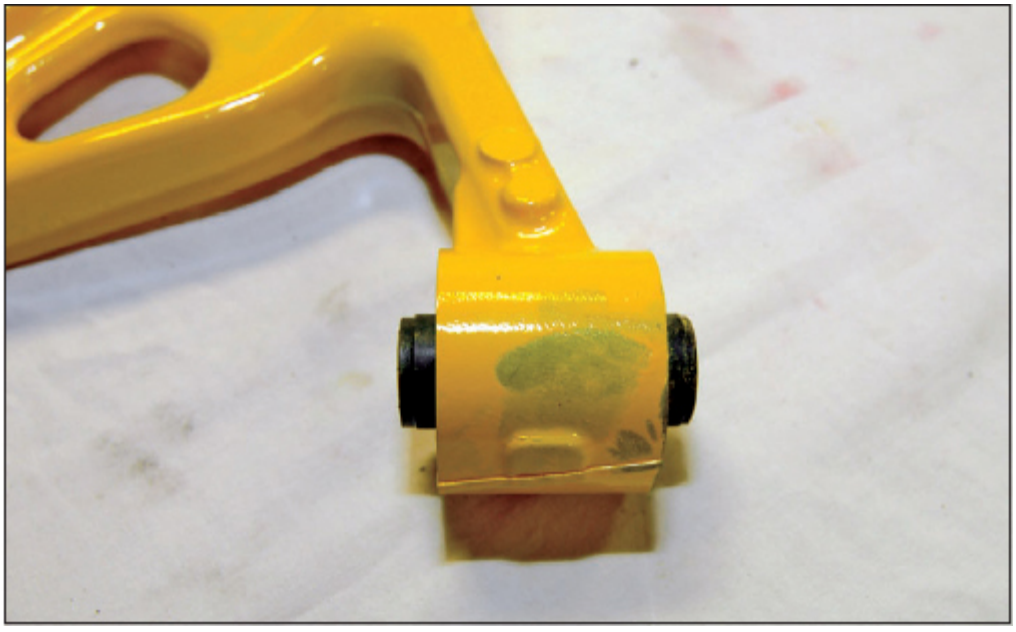
Recovering from Mistakes

If you smudge the powder before it is cured, the repair is easy. If it's a little smudge, you can just reshoot the affected area. Build up some powder and it flows together just fine.

If your part has several smudged or flawed areas, you simply disconnect your gun from the air hose, connect your blower, blow the powder off the part, and start over. This is usually the correct and best response, especially if you are coating a part you want to be perfect and visible when it's in use. I've said it before, but it's worth repeating: Powder is relatively expensive, but not so expensive that you have to live with a mistake that you discover before baking your coating. Bad results last a long time!

Here's a project that will really take some abuse. This is a front lower control arm for a Subaru car. Suspension pieces get sandblasted, doused with water and mud, and sometimes frozen and subjected to salty snow and ice. A good coat of powder protects this aluminum part from oxidization.

Eastwood yellow powder looks great on this part. I cured it using bolts and a wire hanger to suspend it in the curing oven.



Unfortunately, I made a smudge as I put the part in the curing oven. I could try to strip this end and redo the coating, but I won't because it will

be hidden from view and it still has some protective covering on it.

Here's the control arm hung from the ladder, all coated. I know the owner will replace the rubber bushings before installing the part, so I didn't mask them. I handled the part by those bushings, to keep the rest of the finish from smudging.

For this project I decided to apply a second coat of powder to get better color and coverage. I masked the outside because I had already put the red coat on and cured it. This is ordinary masking tape, so I removed it before curing.

Here's the second coat ready to go back in the oven. The line between the yellow and the red is crisp and I have wiped the outside to prevent overspray from curing.

Two coats of the Harbor Freight powder look much better than one. A second coat of red on the outside would probably look better, too.

The Harbor Freight red covered better than the yellow, and looks quite serviceable for a nondress part.

If you have already cured the part when you notice a flaw, it takes more time and effort than if the part is uncured. You need to use gel stripper to take the powder coating off and start over. Although it is possible to add coats of powder, this does not generally cover up major errors.

Cleanup

Like so much with powder coating, cleanup is easy. For the most part, you just sweep up whatever ended up on the floor. If you use a drop cloth, you can just carry it outside and shake it out. Powder is nontoxic and can be thrown away in the household trash.

It is important to clean your powder coating gun as soon as possible after every use, for several reasons. If you forget to blow your gun completely clean, you will have a blast of the old color in the first application of the new color the next time you use the gun. This will spoil the coat on the next part and you will have to blow it off and start over.

If you leave powder in the gun for any length of time, moisture in the air may cause the powder to clump and stick to the inside of the gun and its air passages. It takes only moments to blow your gun clean, and you should do it while your parts are in the curing oven.

Cleaning a powder gun is easy. Unplug the air line and plug in a blower. Just blow over the surface of the gun and up each of the tubes while pulling the trigger. Also blow out the barrel of the gun, or you will get a blast of old color when you start your next project.

You can afford to be extra finicky about blowing out all the old powder. The whole process takes about 30 seconds to completely clean your powder gun and the surrounding area.

Oven Cleaning

You can clean your curing oven by running it through its normal cleaning cycle. This cycle heats the oven past 800 degrees F, and it turns any powder coat stuck to the inside of the oven into ash. You can just wipe the oven clean afterward.

Project: Powder Coat Application

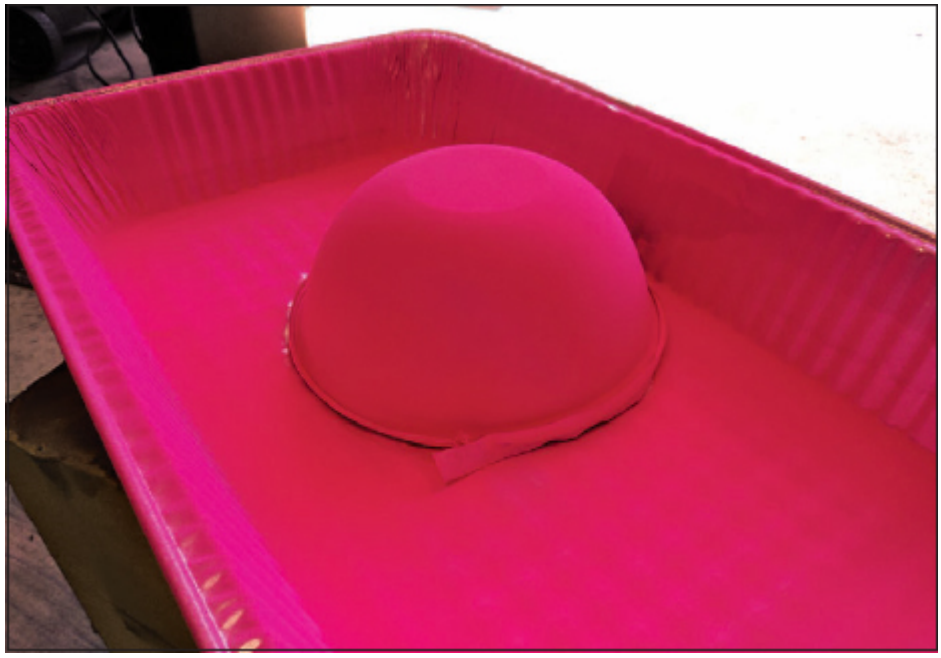
Applying powder coat is extremely easy and effective in just a few steps. When you have a good, thick layer over all parts you want covered, you're ready to cure the powder. Follow these steps for every project:

1 Lay down a drop cloth to catch your overspray. This is easier than sweeping up later. If you are working in your garage, cover your cars, workbench, and anything you don't want covered in powder!

2 Make sure the part is completely dry and clean. Set it on a box, table, or rack, or hang it from something so that you can work on it conveniently and without smudging it.

A simple cardboard box makes an effective stage for powder coating. You can use tables or anything, really, but the box can be taken outside, blown off, and reused indefinitely. Or you can simply recycle it when you're done.

3 If you plan to use a baking rack or a cookie sheet in the oven, put it in place now. It's okay if some powder gets on those items. They will end up with hundreds of layers of powder on them over time.



I placed this stainless steel mixing bowl into a foil turkey roasting pan for coating. The powder on the pan cures, but you can just keep adding coats without any worries.

4 Be sure that you are setting up within a few feet of your workspace. Wires and an air hose tether your powder gun to the transformer and the compressor. You need to get all the way around your project part without dragging the wires over it.

5 Connect the ground wire to the part. If you start coating and you notice that the powder is not sticking, chances are good that you forgot to connect the ground clip!

You don't have to actually clip the grounding wire to the part. If your part is sitting on a box or table, just put the clip under the part. As long as there is metal-to-metal contact, the process works.

6 Prepare your powder coating gun: Fill a cup about 1/3 to 1/2 full of your chosen color of powder and install the cup on the gun.

This Chicago Electric gun is ready to use. The powder is in the cup and the cup has been installed on the gun. The air hose with regulator is connected, and I am ready to coat.

7 Connect the pressure regulator to the gun and the air compressor line. You can get short lengths of air hose that make this part easy. Set the regulator to a pressure that works well. Most guns specify 5 to 10 psi, but I found that 15 to 18 psi works better with my regulator.

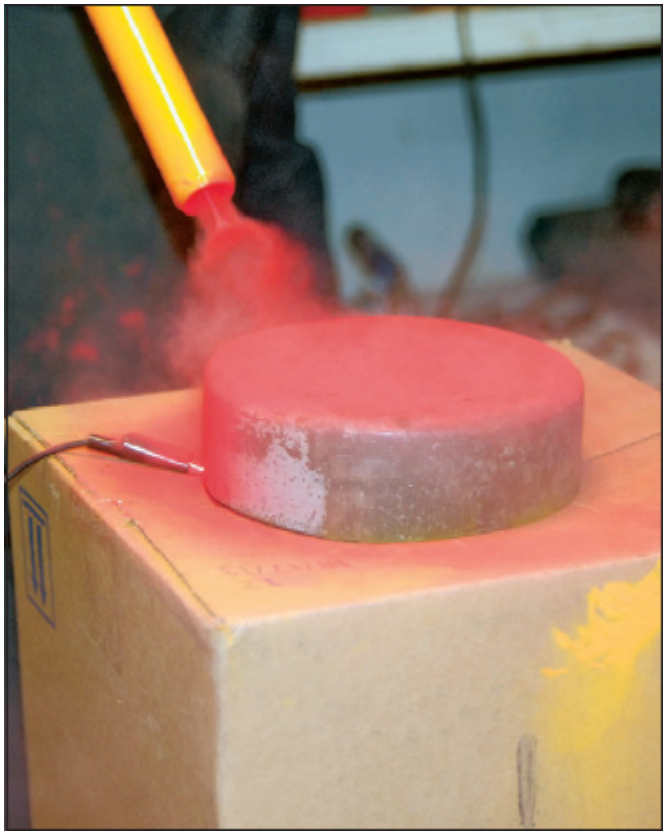
The pressure regulator uses a knob to set the pressure allowed downstream from the regulator. Set your regulator to the pressure recommended for your gun, then try slightly higher or lower pressures to see what works best with your setup.

8 Put on your respirator, goggles, and rubber gloves (if you choose to wear gloves). Any powder on your skin washes right off. But powder in your eyes itches for about a day, and powder in your nose and mouth has you coughing and stuffy for at least several hours.

Don’t skimp on safety gear! Get a complete set of protective gear. The earmuffs and earplugs protect your hearing when your compressor is cycling or you are using power tools. Extended exposure to loud noise damages your hearing, but even short exposure is fatiguing. You feel better and work better with quiet in your ears.

9 Make sure you have the trigger in one hand and the gun in the other. You can also use your trigger hand to hold the air hose and wires out of the way.

10 Squeeze the trigger to activate the electrical current. Then pull the trigger on the powder gun. You should hear air flowing through the gun and powder should start coming out immediately. If you don’t get a good puff of powder, shake the gun to get the powder moving in the cup. You can adjust the air pressure if it’s not working.



When you pull the trigger on the gun, you should see a generous cloud of powder coming out of the end of the gun. It should hit the diffuser and form a cone; the powder should be obviously attracted to the project part.

11 Working about 6 to 12 inches from the part, move the gun back and forth while dusting the surface with powder. Go all around the part and spray a good, even layer. When you think it's too thick, it's just barely enough. Be generous with the powder layer.

As you spray the powder, move the gun to all areas of the part and give every area equal attention. Thin places may show up and you have to strip and recoat if you give any area less powder than others.

Always deliver a good, thick coating of powder. It cures down to a thin layer, so be generous with your application, especially on the sides of indentations.

Curing the Powder Coating

Once the part is in the oven, the only thing you have to do is allocate enough time to let the part come up to temperature and cure the powder. The temperature and cure time vary based on the powder's composition; it should be listed on the powder's packaging. This is one place where using well-known powders, such as those from Eastwood, offers a big advantage. Some powders you buy on the Internet do not come with specific instructions about time and temperatures. They come in a reseal-able bag and you have to guess.

As a rule of thumb, you can expect solid colors to cure in 15 minutes at 350 degrees F. Clear or translucent colors should be cured at 375 degrees for a minimum of 25 minutes. However, some powders have cure temperatures up to about 400 degrees, so make every effort to get instructions with every powder order. Purchase an oven thermometer at the grocery store to double-check the accuracy of the oven's internal thermometer.

Once you have the part in the oven, resist the urge to check on it until the allotted time is up. Otherwise, you just let heat out and potentially compromise the cure. When the timer goes off, you can open the oven and let the part cool in place (recommended for really heavy parts that hold a lot of heat) or you can remove it and let it cool outside the oven.

When the part is cool enough to touch with your bare hands, you can test the cure by digging your thumbnail into an inconspicuous place. If you can make a mark with your nail, it's not cured. This is more often the case with heavy, solid parts that may not be able to come up to temperature in the standard time. Although the heat works to cure the powder on the surface, the cold metal is keeping the powder close to the substrate from curing.

One critical key to getting really great results is to be sure the curing temperature is right. It's okay to be off by 5 or 10 degrees, but not more.

Another key to good results is to avoid the temptation to check on your part while it's curing. That can affect the finish and shine. The part is done only after the specified curing time.

Oven Timer

Most ovens have timers that automatically turn off the heat when they expire. If you're like me and you get busy with another project while one part is curing, you might forget to turn off the heat and remove your part on time. The oven timer helps with that. A portable oven timer is handy if you plan to go inside the house during the cure. You can get these at a thrift store for just a dollar or two.

You can leave a part in the oven longer than specified if necessary. Powder coat is more sensitive to the temperature than to the length of cure time.

You can also take a little solvent (such as Eastwood PRE Painting Prep) on a shop rag and rub it on the coated surface. If you can rub off some of the powder, it's not cured.

Infrared Lamps

If you have projects too large for a conventional oven, you have two choices: send it to a commercial coating shop or invest in an infrared curing lamp. These cost several hundred dollars and come in a variety of sizes, but you can cure just about anything as long as you’re patient about it. You set the part up in front of the lamp and systematically direct the heat radiation onto each portion of the project for the specified time.

Shop Lights and Heat Gun

As an experiment, I decided to attempt to cure a small part using ordinary halogen shop lights. If you have ever used these, you know how hot they become. I coated a thick steel washer with Eastwood gloss black and placed it on a concrete floor, then arranged three halogen work lights closely around it and facing the part.

After 30 minutes the surface temperature of the washer as measured with the handheld infrared thermometer was about 250 degrees F, and that was as hot as it got. Yet the powder passed every test for cure: It is not subject to ordinary solvents, it is hard, and it does not come off the part.

A standard hardware store heat gun can also be used to cure powder coat under certain circumstances. These guns have a variety of settings and can create temperatures between 250 and 1,000 degrees F or more. The risk is getting your powder coat too hot.

I coated a thick steel washer and put it under three halogen shop lights. I checked the temperature with an infrared thermometer, and the coating

reached about 250 degrees F, which was enough to melt the powder. I kept the heat on for about an hour, and it seemed to cure adequately.

After an hour the coating melted, flowed out, and is now shiny! To be extra sure of a full cure, you could let the powder melt and flow under the lights, then finish the cure with a heat gun.

The challenge with heat guns is that they have blowers to transmit the heat from the gun to the part, and so the powder may be blown off your part before it is hot enough to flow out. But if you made the powder flow with your halogen lights, you can complete the cure with a heat gun. Just move the gun around a little to evenly heat the whole surface; be sure to work in sections on larger pieces.

Preheating to Help Cure

One technique that yields good results is to preheat your part before spraying the powder. If the part is heavy enough to hold heat, preheat it to

about 350 degrees F in your curing oven, and then take it out and hang it or set it down for coating. Have your gun ready and apply the powder coat while the part is hot. The powder begins to melt and flow out as soon as it hits the hot metal, which increases the amount of powder that sticks.

Give the part the same thick coat you would give a cold part, and then place it back in the oven at its cure temperature for the specified cure time. You get a great, thick coating with a lovely finish.

I preheated this cast-iron pan to 350 degrees F in the curing oven. Then I removed it and hung it for coating. The powder behaves differently with a preheated part, sticking to it and flowing out immediately.

There was less overspray on the floor with the preheated part because the powder was melting and sticky. The effect worked well with the purple mixed powder.

After coating, I hung the project in the curing oven again and cured it properly. I was rewarded with a lovely result, and the shine is not diminished in any way.

This experiment was a complete success! The effect of the color is beautiful, the powder went on nicely, and it was easy to do. Preheating your parts can definitely improve your powder coating results.

This bell was made from the bottom of a welding gas bottle, which I cleaned with a wire cup brush. I thought a silver/chrome finish would look great on this project.

Curing Multiple Coats

For some projects, you may find you need more than one coat. Some powders, such as metallics, benefit from a clear coat over the color coat. Some projects are complex and require two coatings to get everything covered and cured. Or you may have a desire to do a two-tone project.

In most cases, a multiple cure is not a challenge. Just remember to cure the powder with the higher curing temperature first, and don't heat the part more than a few times.

Clear coats are the most common multi-coat scenarios, and they are straightforward. Hang the part or use whatever method you chose for the color coat, and cure the clear coat.

I used the Eastwood HotCoat gun and chrome powder to coat the whole outside of the bell, including the hanger. The first cure ended up a little

soft, probably because with the great weight and mass of the bell, the powder did not reach full curing temperature. I put the bell back in the curing oven for an hour, and the powder hardened.

Metallic Powder

Metallic coatings are nothing short of amazing, but they need to be carefully applied and cured for best results. Preparation of the part surface is absolutely key. To achieve a chrome-type or gold-type finish, the part must be absolutely smooth before you apply the coat. Metallic finishes use real metal powders, and therefore are not as impervious to weather as other powders. Give your metallics a clear coat if you plan to use them outdoors.

I performed two projects with Eastwood Chrome powder and got excellent results. The first was a garden bell made from the bottom of an old steel welding bottle. This part was extremely heavy and a challenge to move, but the feature that kept the chrome from being as reflective as possible was the comparatively rough surface of the bottle. However, the surface is still nicely reflective and benefitted from a later recoat with a clear gloss to bring out the chrome color even further.

The coating turned out great, although it's more of a reflective silver than chrome. With more practice and perhaps a coat of clear gloss over the top of the chrome powder, I will get a truer chrome finish.

The second chrome powder project was a cast-aluminum sailing ship, which will be the wind catcher for the bell. I cleaned it and used solder to fill a hole in the casting. Then I used hand files to file the solder bead level with the surrounding metal.

Here is the project all cleaned up and ready for powder. I will give it a good coat of chrome finish to match the bell.

The cured chrome powder does not look much different from the polished aluminum it's covering, but the powder protects the metal while looking great! I will cover it with a layer of clear gloss before I put it outside, however.

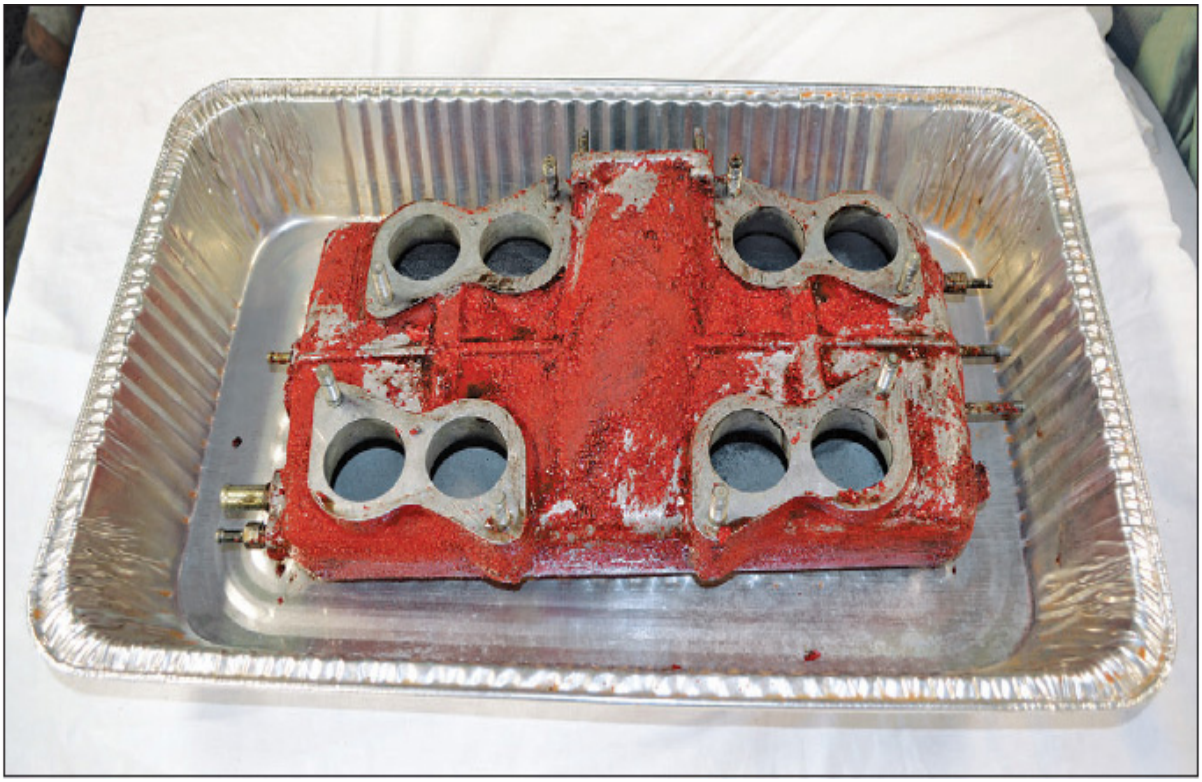
The second project was a small aluminum casting of a sailboat, which became the wind catcher for the bell. This project was also a solder test to remove an unwanted hole. The smoother finish of this piece yielded a much more reflective surface with the chrome powder.

Wrinkle Finish

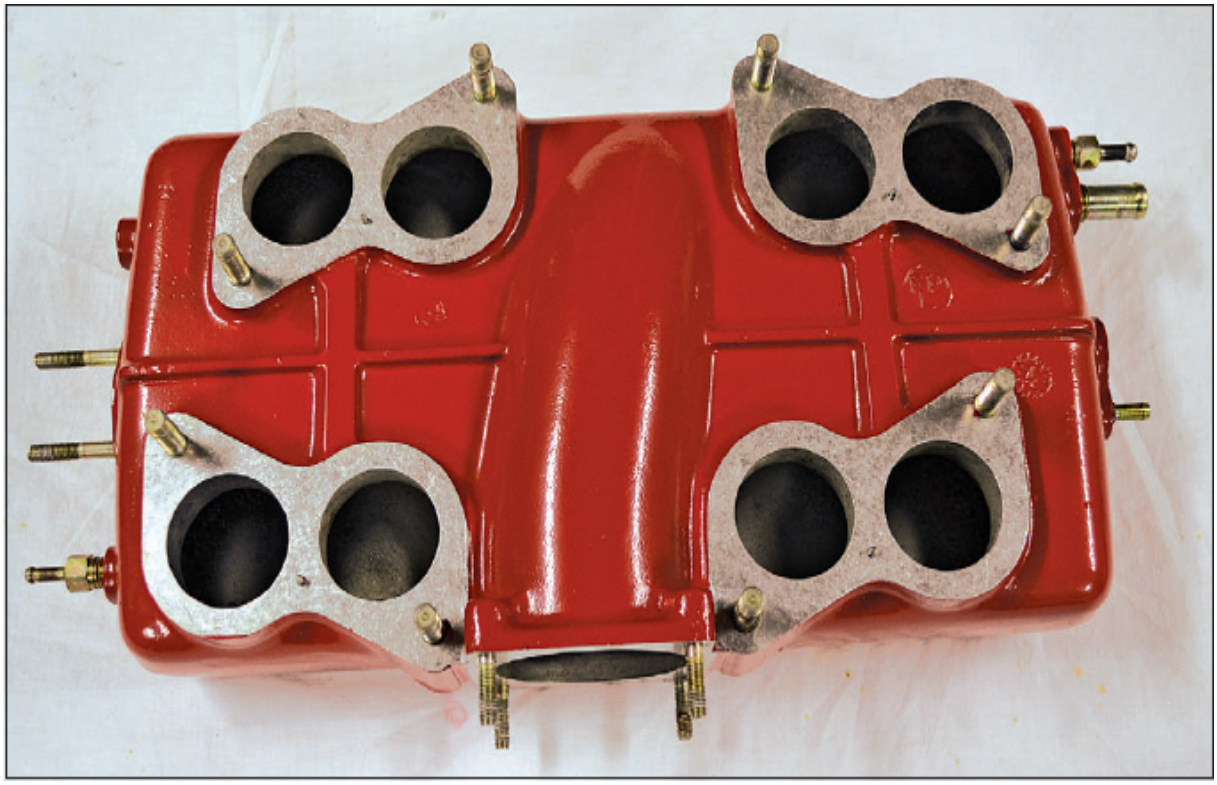
Without a doubt, one powder that should be in your arsenal is Eastwood's black wrinkle-finish Wrinkle coat. It is often used on automotive parts such as intake manifolds. This high-quality powder gives effortlessly great results. There's no trick; you just apply it and cure it according to the instructions on the cup and you have a perfect wrinkle finish.

The perfect complement to black is a red wrinkle coat, and I tested a different brand purchased on eBay. I tested the two wrinkle colors on two different parts. A pair of intake manifolds for a vintage VW engine received the black coating, while the intake plenum and throttle body to a Ferrari received the red. The wrinkle effect in the red powder barely came through, but otherwise created a good coating with a true red color. Unfortunately, Eastwood does not offer a red wrinkle coat at this time.

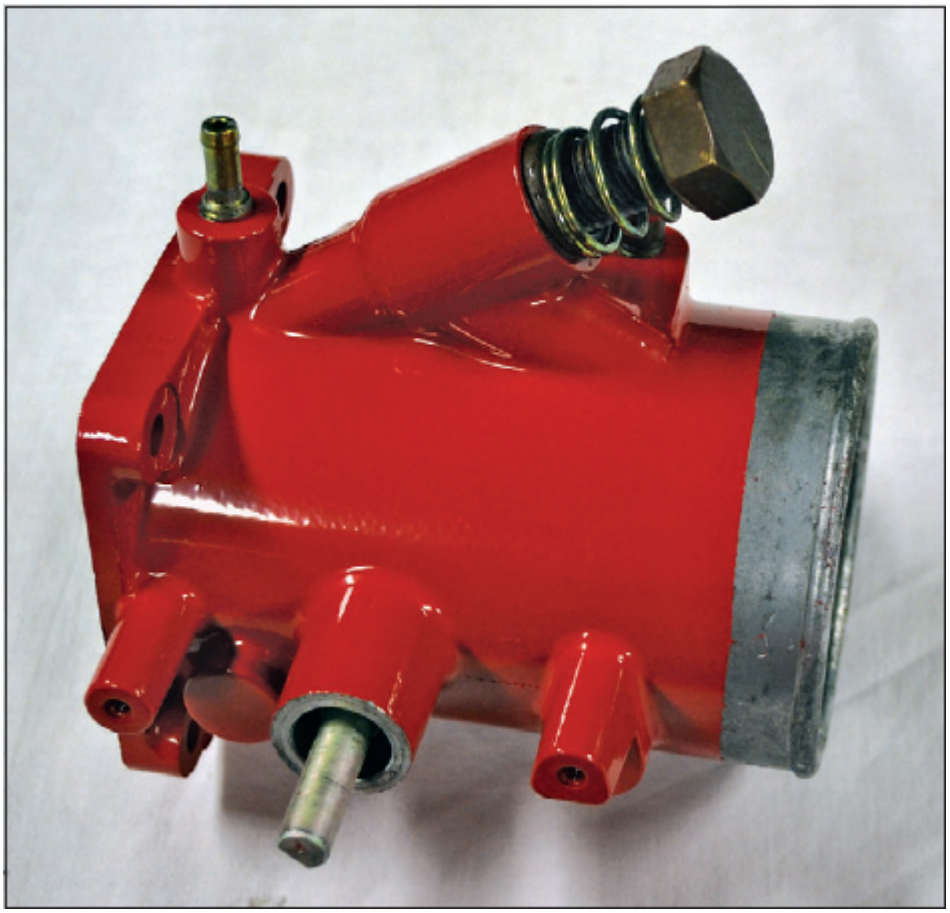
These VW intake manifolds were coated with Eastwood black wrinkle finish and look amazing.



For a red wrinkle coat test project, I selected this intake plenum from a Ferrari 308. I stripped it with Eastwood gel stripper and the old original paint came right off. I used a foil tray to contain the gel stripper and waste products.

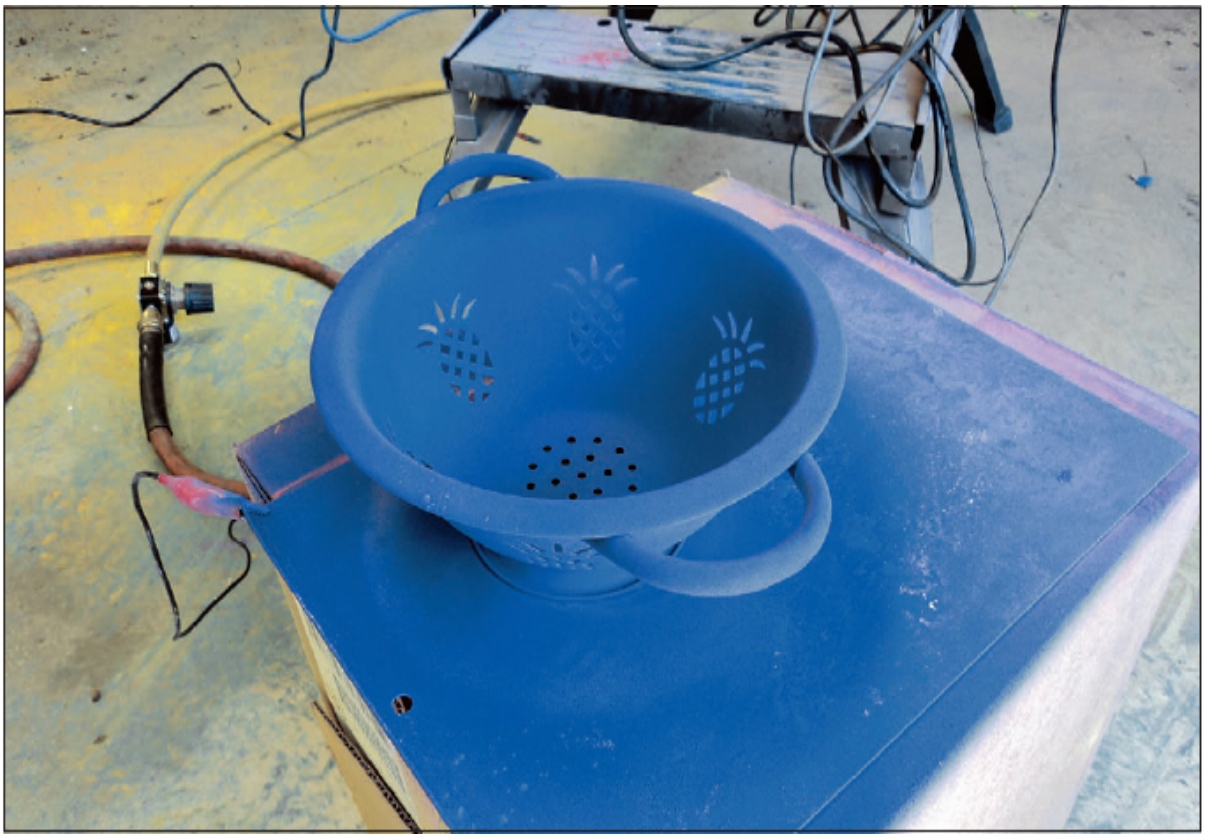


Here's the result. I used a generic red wrinkle powder purchased on the Internet. Although the coating cured hard and looks great, it didn't wrinkle! So I ended up with more of a gloss red finish, and that's okay.



This Ferrari throttle body was cured in the same red powder. You can see that it's nice and smooth, rather than wrinkled.

Powder coating manufacturers do not recommend powder coating items that come in contact with food. I decided to coat this stainless-steel colander. It had a few rust spots and scratches, and a nice blue would make it festive.



Note the color of this generic powder as it goes on the colander. I bought this powder to be a nice medium blue, and my prior experience with powders led me to believe that this is the color I'd get.

Miscellaneous Coating Challenges

Some projects present different challenges, including complex shapes, certain sheet-metal items, and alloy wheels. When powder coating these items, you need to take the correct steps so that powder is properly distributed on all surfaces, and as a result, the final finish covers the entire object.

Color Change

From time to time, color change occurs during the curing process, usually with off-brand powders. This is sometimes associated with curing at a higher temperature than the powder needs. If you have ensured that this is not the case, it may simply be an attribute of the powder and there's nothing to do about it but note the phenomenon and take it into account.

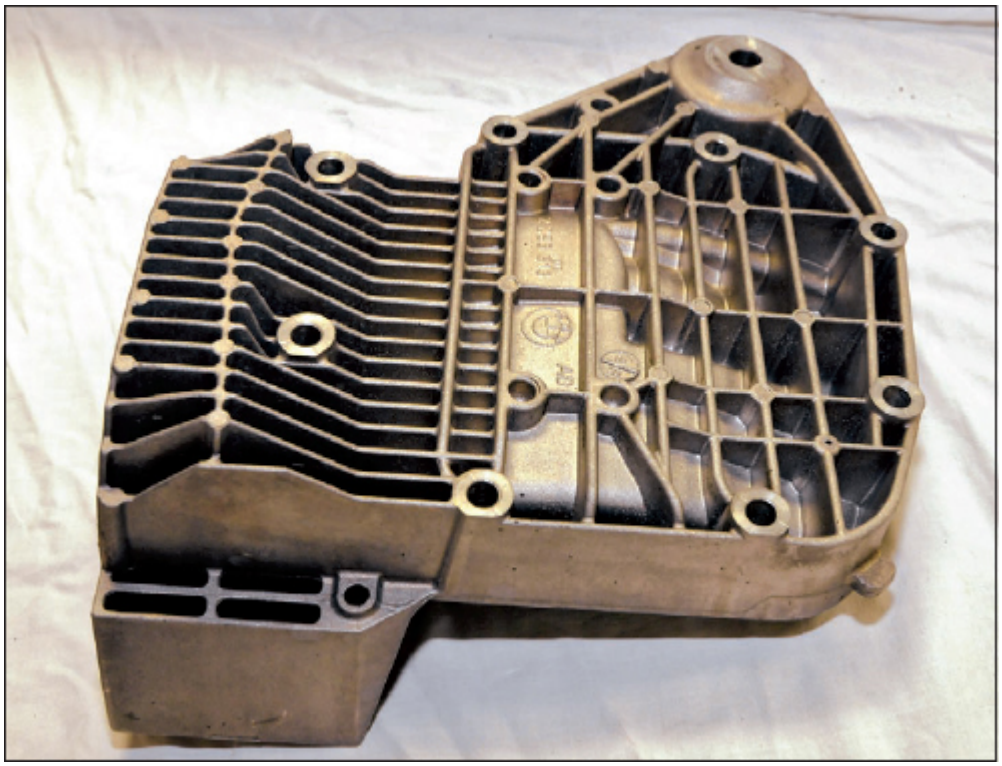
I was surprised to find that this blue darkened to a deep navy blue color in the curing process. Further testing showed this was not a mistake in curing temperature or time but just the way this blue cures. Always test your powder before committing it to an important project.

This is a good reason to always test your powders on scrap parts before coating a part that you really want to be perfect.

Complex Shapes

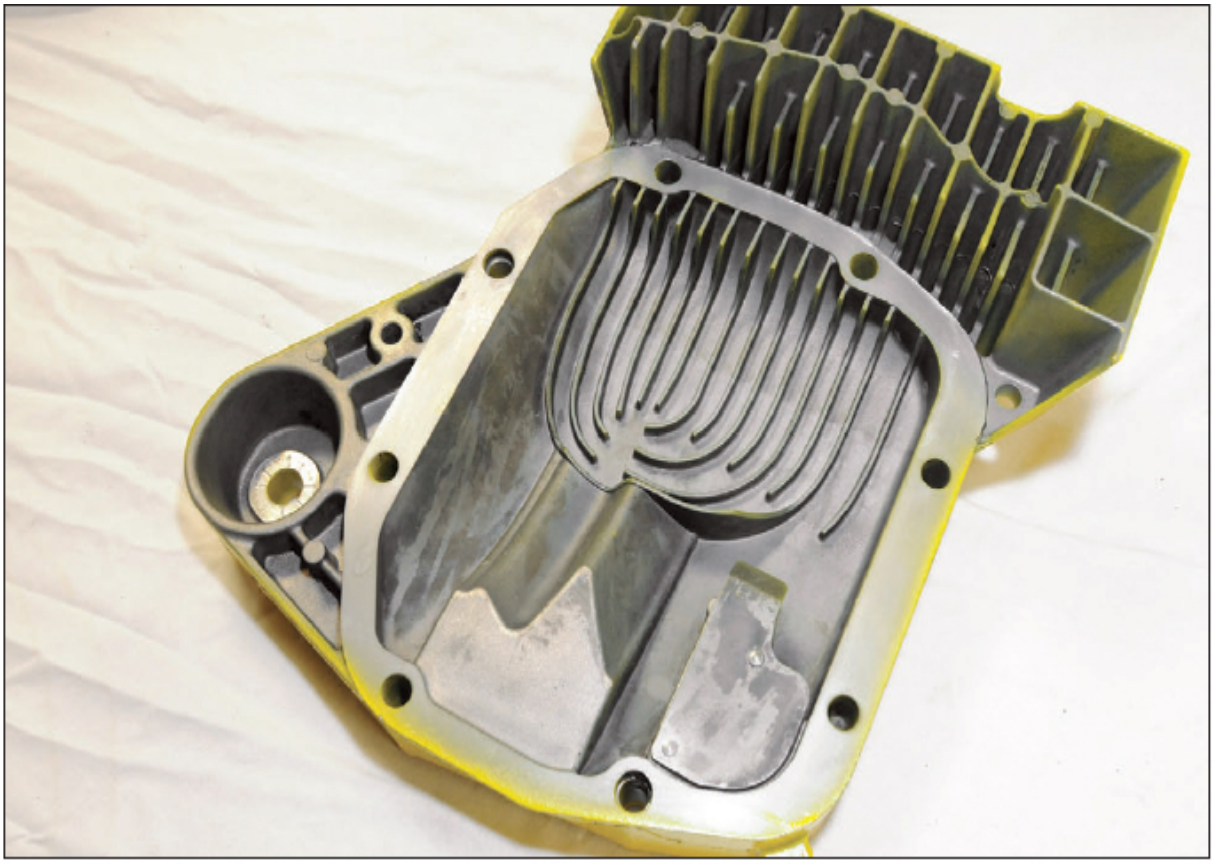
Complex shapes pose a particular challenge to the powder coater. Not only do you have to get into all the nooks and crannies with the powder, but the nature of the electrical charge that attracts the powder particles also behaves differently in valleys and holes. The powder is attracted to the ridges of the part, and you have to work carefully to get powder into the crevices. This effect is known as a Faraday Cage, and the practical effect is that your powder does not deposit evenly.

One technique that helps avoid this is to remove the diffuser disc from the front of your gun, and shoot powder directly into the holes. Alternately, hold the gun sideways with the diffuser disc in place, encouraging the sideways flow of the powder into the holes. In extreme cases, you can even use the gun without the electrical flow and rely on gravity to put some powder onto every surface.

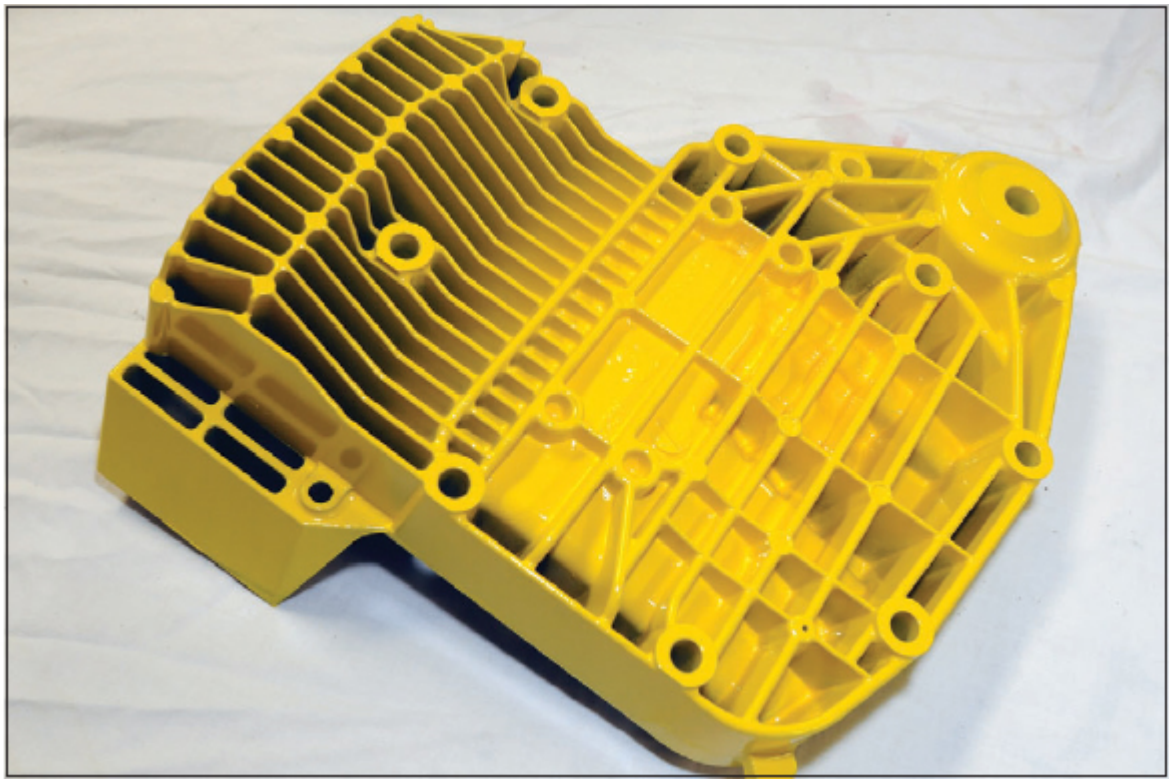


This BMW differential housing cover is a complex shape to coat. The ribs and valleys help this part stay cool and also provide structural rigidity. It is made from cast aluminum alloy.

I plugged the holes in the front where I will coat the part. The back (that will not be coated) was a great place to attach the ground wire.



You can see a little overspray on the back, but once cured it doesn't affect the usability of the part in any way.



To get powder into the valleys between the cooling ribs, I turned the gun sideways and boosted the air pressure a little. It wasn't perfect, but it worked. This will be a nice dress-up item under the rear end of a racing BMW.

Eastwood Gun Setting

If you have an Eastwood Dual-Voltage powder gun, use it on the low-voltage setting to reduce the Faraday Cage effect.

Sheet Metal

A neighbor showed me a couple of sheet-metal lawn sculptures that had been cut out on a computer-controlled plasma cutter. Over time they had rusted, and he thought they would look better with a bright powder coating.

A friend brought over two motorcycle cutouts obtained at a craft fair. They'd been outside in his garden for a while and rusted over. He thought they'd look good with a nice powder coat color on them. But first, they needed a major cleanup.

The first step was to get rid of the rust, which was accomplished easily with Eastwood's Rust Dissolver, aided by a wire wheel on my bench grinder. Then it was determined that one should be red wrinkle and the other should be smooth orange.

Because they needed every point covered on both sides, I hung them from a ladder using safety wire. I wanted to avoid the tiny gaps in coating that result when you attach the grounding clip to the part, so I attached the grounding clip to the steel safety wire. This provides enough of a path for the electricity so that the powder sticks to the metal as usual. A little more

testing found that the clip could be placed on any metal piece with an unbroken touching connection with the part, and the electrostatic effect worked.

I soaked the pieces in Eastwood Rust Remover and that took care of almost all the oxidization. Some quick work with the wire wheel completed the cleanup.

I coated the smaller cutout with the red wrinkle finish that I purchased on eBay. Because I was doing both sides, I hung it from the ladder with safety wire.

In contrast to the results on the Ferrari manifold, the red powder wrinkled up perfectly this time. Perhaps it was the lighter mass of the cutout that allowed the powder to respond differently.

I coated the larger cutout in flat orange, hung it on the ladder with safety wire, and used a ground path through the safety wire and the metal

ladder support bar. The powder adhered to the part just fine. This will be a nice bit of color that will last for years in my friend's garden.

Alloy Wheels

Refinishing automobile wheels is a popular use of powder coating. Luckily, all but the largest wheels fit readily into a standard kitchen oven, so you can do this work yourself and get great custom results that hold up well to the wear and tear of driving.

Working on steel wheels is straightforward: Simply clean them of all rust and paint. Paint is easily removed with media blasting or chemical stripper. You can decide if you want to coat only the outward-facing surface or the back as well.

Wheels with complicated patterns may pose a challenge, especially if you want to limit your coating to particular areas. It's best to plan on coating the entire outward-facing side.

Alloy wheels may be different from steel, however. Alloys are usually clear-coated at the factory, and at a minimum that coating must be scuffed up to provide adhesion to the powder. It should not damage the wheels to treat them with gel stripper to remove any prior coatings, but test the stripper on a small area first to be sure.

Alloy wheels take a lot of abuse from the weather, UV light, and road hazards. A nice coat of powder is one way to revive an old set of alloys. This Honda wheel can go from boring to beautiful in an hour.

I scuffed the surface of the Honda wheel with sandpaper, and then wiped it down with PRE metal prep and coated it with Eastwood's mirror black powder. This 19-inch wheel fits neatly into the curing oven with room to spare.

This wheel now looks fantastic, and the powder coat will hold up much better against the elements. Some people have theorized that the curing process weakens an alloy wheel, but at a cure temperature of 350 degrees F, this process is far from the temperatures needed to affect aluminum structurally. Many automakers now deliver alloy wheels already powder coated.

There are rumors that powder coating alloy wheels weakens them because of the curing temperatures. Some alloys of aluminum (notably 356 aluminum) have a low temperature tolerance, but reports of weakened wheels are anecdotal and many automakers include powder-coated wheels

as standard equipment. If you are concerned about weakening your wheels, you should avoid powder coating.

Powder Mixing

Powder manufacturers generally recommend against mixing powders of different colors because powders do not truly “mix.” Instead, the particles of the different colors mingle, often randomly and imperfectly, and create an effect of interspersed points of color between the two (or more) colors.

But this has an interesting effect on the human eye, which averages the colors it sees if the points are small enough. In fine art, the technique is known as pointillism and it creates a deep color.

I mixed up a batch of “purple” by combining Eastwood gloss red and Ford blue powders. This created an attractive mix that is never the same twice. When viewed from different angles, the same area of a part appears to change colors from more red to more blue. The effect is mesmerizing! (I used the same mixed powder on a frying pan for the preheating test to good effect as well.)

As noted many times, if you don’t like the results of your powder coating, you can easily strip the part and start over. So why not experiment with color mixing?

You've seen the results of some color mixing in Chapter 1. To arrive at this particular color, I mixed Eastwood red and blue in a fresh cup and gave it a good shake to mix up and randomize the particles.

Two-Tone Projects

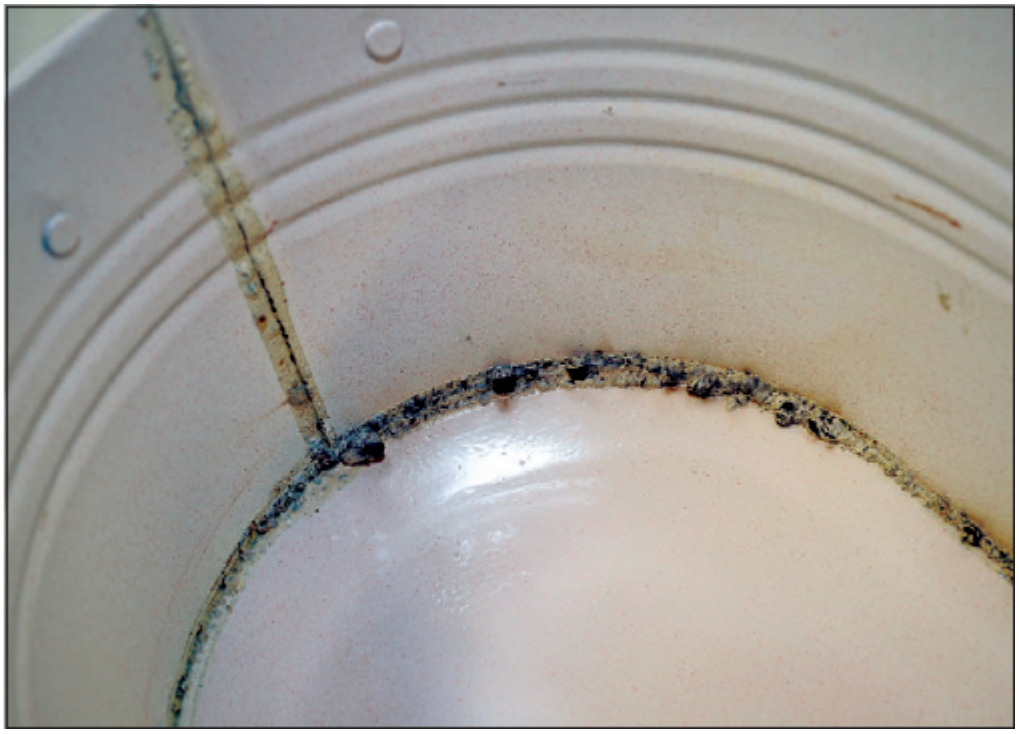
I experimented with a few two-tone projects because they are the most challenging. The most notable was a small galvanized tub suitable for tabletop use. Galvanization involves electrodepositing a layer of zinc onto sheet metal to help prevent rust.

To achieve a two-tone finish, I first laid a layer of deep green on the outside of the tub and cured that finish. Then I coated the inside white. To my surprise, an impurity (probably glue or sealant) appeared in the white coat on the seams of the tub. That impurity bubbled up and burned in the curing process, spoiling the finish at the seams. The interior really needs to

be stripped and recoated. However, the powder has no issues adhering to the clean zinc coating.

The principle of two-tone coating is sound. Most powders on the market are thermosetting and do not melt twice. So if you can mask the part effectively you can cure in two stages and achieve a unique and artistic effect without much trouble.

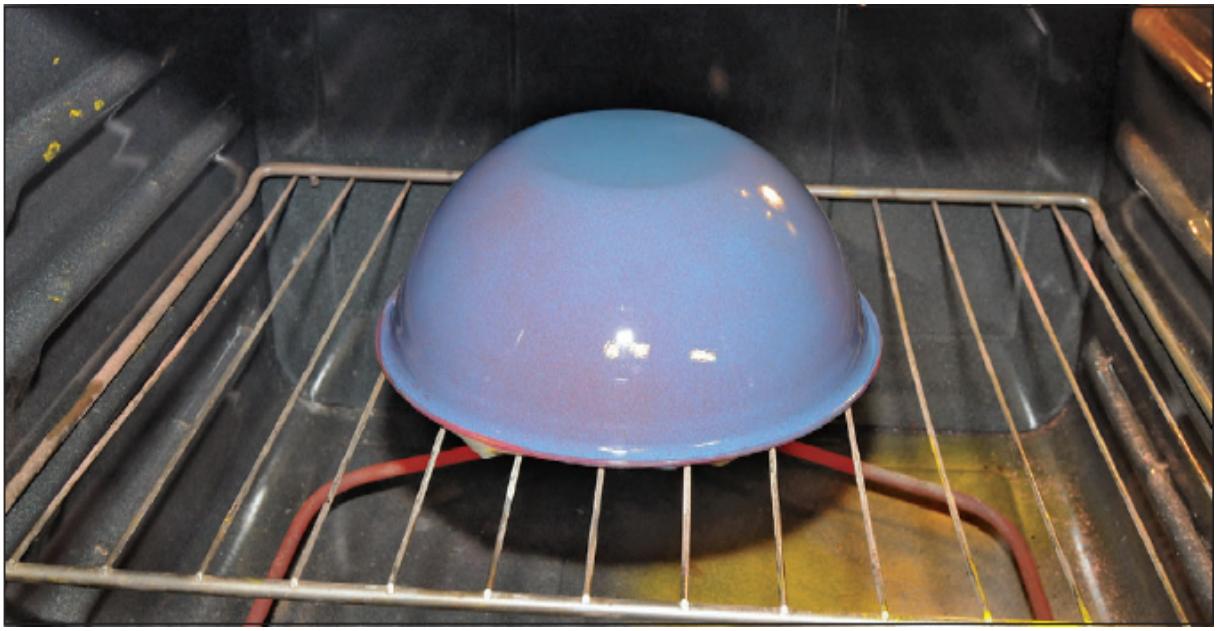
This galvanized tub was meant to be decorative, with a shiny coat of tin over the base metal. I thought it would look good with a two-tone powder coat.



I was not so lucky with the interior. Some kind of glue or sealant bubbled up from the seams during the curing process. This contamination ruined the powder finish.

When I scraped away the residue, it was even worse than I thought. This will have to be completely stripped and carefully cleaned before recoating. But the good news is that process is easy, and I'll get better results next time!

The outside of the project went well, with Eastwood green powder giving good coverage and deep color. The powder adheres to the tin surface very nicely.



The mixed powder changes color as it cures. The two powders cure at the same temperature, so there was no question about selecting a cure temperature or time.

The effect of a mixed powder is that your eye is fooled and the surface appears to change colors as you look at it from different angles. This formerly ordinary stainless steel bowl is now spectacular!

Source Guide

All Powder Paints
4185 35th St. N.
Saint Petersburg, FL 33714

727-851-9815

allpowderpaints.com

Caswell Plating
7696 Rte. 31
Lyons, NY 14489

855-227-9355

caswellplating.com

Columbia Coatings
1173 Industrial Park Rd.
Columbia, TN 38401

931-388-7730

columbiacoatings.com

Eastwood Company
263 Shoemaker Rd.
Pottstown, PA 19464

800-345-1178

eastwood.com

Harbor Freight
P.O. Box 6010
Camarillo, CA 93011

800-423-2567

harborfreight.com

Powder Buy The Pound
2011 Johnson Industrial Blvd.
Nolensville, TN 37135

855-976-9337

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